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THE

GUN, RAM, AND TORPEDO.

MANŒUVRES AND TACTICS

OF A

NAVAL BATTLE IN THE PRESENT DAY:

THE INFLUENCE OF MODERN SHIPS AND GUNS, RAMS, TORPEDOES, AND OTHER WEAPONS, ON A NAVAL ACTION IN THE OPEN SEA.

Prize Essay,

BY

COMMANDER GERARD H. U. NOEL, R.N.

TO WHICH ARE ADDED TWO ESSAYS:

BY J. K. LAUGHTON, ESQ., M.A., F.R.A.S., F.R.G.S.; AND

LIEUTENANT CHARLES CAMPBELL, R.N.

WRITTEN IN COMPETITION, FOR THE

PRIZE OF THE JUNIOR NAVAL PROFESSIONAL ASSOCIATION.

With numerous Illustrations.

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INTRODUCTION.

THE JUNIOR NAVAL PROFESSIONAL ASSOCIATION was established in January, 1872, with the design of affording increased opportunities of instruction and information to the Junior Officers of the Royal Naval, Royal Marine, and Royal Naval Reserve Services, on all questions of professional and scientific interest.

Although the career of a young Officer of the Navy furnishes unrivalled facilities of acquiring a practical acquaintance with his profession, as well as of obtaining much useful and varied information in other branches of knowledge, a lack has hitherto existed of any definite opportunity of collecting and comparing the different experiences of services in various parts of the world; or of obtaining that light on debated professional questions which results from discussion and the conflict of opinion.

To supply these deficiences is the chief object of the Association. First, by establishing, with the sanction of the Lords Commissioners of the Admiralty,

Societies in the various Naval ports for reading and discussing papers on professional and scientific subjects; and secondly, by keeping members serving abroad constantly informed of the leading features of professional and scientific progress.

The Association at present numbers nearly 300 members.

Towards the close of the Winter Session for the past year, in order to further encourage professional study on the part of Officers of the Navy, the Committee offered, in accordance with a Resolution passed unanimously at a general meeting of the members, a Prize of 50 Guineas for the best Essay on Naval Tactics.

The following were the conditions:—

SUBJECT—"The Manœuvres and System of Tactics which Fleets of Ships of modern construction should adopt, to develop the powers of the Ram, Heavy Artillery, Torpedoes, &c., in an Action in the open Sea."

⁂ NOTE.—It is desirable that the proposed systems should be applicable to existing ships; it is, however, open to a writer to suggest any improved form of ship which may seem to best suit the advance made in Gunnery, Torpedoes, &c.

DEFINITIONS :—

The following definitions have been suggested to illustrate the sense in which the terms are used in the Title ; but all nomenclature of the art of Naval War being imperfect, a writer may use such definitions as may appear applicable.

STRATEGY :—Combinations made by the Commander-in-Chief of a force acting on different points over a large area, to compel or annul certain movements of the enemy, to unite or separate portions of a large sea force, &c.

MANŒUVRES :—Movements of the whole force, or of any detached portion of it acting in presence of the main body, by which a position of advantage is sought to be gained ; whether in the open sea, in the vicinity of land, in the presence of a convoy, with regard to wind and sea, &c.

TACTICS :—Formations for attack and defence ; all the possible evolutions which ships, divisions, or squadrons may be called upon to perform, while acting together, *i.e.*, in such order that they are controlled by a general signal. The employment of artillery, rams, torpedoes, and other novel weapons, &c.

I.—Competition is open to all.

II.—The Essays must be rendered to the Hon. Sec., care of Messrs, Griffin & Co., Portsea, before the 1st November, 1873.

THE GUN, RAM, AND TORPEDO.

"It has been written by Lieut. Gerard H. U. Noel, of Her Majesty's ship "Active," to whom we, therefore, award the Prize of 50 guineas.

We are, &c.,

"ALEX. MILNE, Admiral.
"A. P. RYDER, Vice-Admiral.
"A. C. KEY, Vice-Admiral."

The Judges also expressed so high an appreciation of the Essays by Mr. J. Knox Laughton, R.N., and Lieut. Charles Campbell R.N., that it has been thought desirable to publish them with the Prize Essay.

The Committee of the Association cannot but consider the successful issue of the competition as a most hopeful sign for the future efficiency of the Fleet. Of all the questions which engage public attention, none can be said to have greater national importance than that which is at the very foundation of the fighting efficiency of that great service on which the prosperity, the honour, the very existence of the British Empire depend.

Junior Naval Professional Association.
Portsmouth, April, 1874.

PRIZE ESSAY.

COMMANDER G. H. U. NOEL, R.N.

"CERTANTI DABITUR."

CONTENTS.

A GENERAL SURVEY OF THE SUBJECT OF NAVAL TACTICS.

PRIZE ESSAY.

ERRATA.

Page 24	last line		for "by being," read "of being."
,, 30	line	12	for "No. 4," read "No. 3."
,, 33	,,	21	for "are formed for the" read "are provided for in the."
,, 33	,,	24	for "three," read "these."
,, 71	,,	19	for "four," read "three."
,, 71	,,	23	for "the," read "and the."
,, 71	,,	24	for "and," read "caused by."
,, 97	,,	9	for "le," read "se."
,, 100	,,	17	for "Chapter II." read "Chapters III., IV., & V."
,, 101	,,	18	for "Chapter II.," read "Chapter III."
,, 102	last line		for "Chapter II.," read "Chapter IV."

However, little as there is to be gathered from experiments actually relating to a Naval Action, let us try what this small amount of data is worth, and, with the help of the history of naval warfare of the past, form some idea of *what the Naval Battle of the present will be; on what various principles it may be carried*

A GENERAL SURVEY OF THE SUBJECT OF NAVAL TACTICS.

CHAPTER I.

It has been stated by most authorities on Fleet Manœuvring and the Use of the various weapons of war—a remark which is obvious enough—that until we have again before us the experiences of a Naval War, our opinions on the subject must principally flow from our imaginations. From the experiments with ships, guns, and various weapons, we obtain a few substantial and trustworthy facts, sufficient perhaps to form a basis on which to work. These experiments and tests are, however, necessarily limited; and when considering the present subject—which, after all, is the end for which all ships and weapons of naval warfare are designed—we cannot but feel how little data there is to guide us.

However, little as there is to be gathered from experiments actually relating to a Naval Action, let us try what this small amount of data is worth, and, with the help of the history of naval warfare of the past, form some idea of *what the Naval Battle of the present will be; on what various principles it may be carried*

out; and which of these principles will in all probability lead to success.

FIRST, THEN, WITH REFERENCE TO GUNS:—

The well-worn controversy of 'Guns *versus* Armour,' possibly still undecided in many minds, has, it appears to me, resulted in favour of the guns as far as ocean-cruising iron-clad ships are concerned. I am convinced that guns may be mounted in such forts as those that now defend our Southern coasts and used with such terrible effect as to prevent even the most thickly-plated vessel at present floating from passing them without receiving fatal injury; much less, therefore, can we expect our ocean cruisers to withstand their fire.

The question which next arises is the use of guns between fleets. Here we have a very different matter, one in which I am far from granting the palm to the heaviest ordnance. Their effect is no doubt extremely destructive, if the object is hit; but heavy ships are required to carry such monsters, and even then only a very few can be mounted. Another consideration is the small per-centage of projectiles that can possibly take effect when the combatants are moving at the high speed now to be attained. The reduction, therefore, in the number of guns, together with the reduction in the rate of firing those of a heavier nature, will materially tell against the system of putting all our eggs into one basket; and I am of

opinion that the next general action will show that a larger number of guns of a lesser calibre will be of greater service.

In a general action I do not hold that the guns will be the principal weapon; but should the ship's engines or steering gear be disabled, temporarily or permanently, her guns will become all-important. Then let her show the enemy what gunners can do. In an action between single ships they will no doubt take a more prominent part—possibly, being the only mode of attack—thus showing, that although general opinion may tend to favour the more lately adopted and more novel Ram bow and Torpedo mode of attack, guns must not be left out of the question.

SECONDLY, WITH REGARD TO RAMS:—

As all ships of the line, lately built or at present building, are constructed with strengthened and sharpened bows for ramming, it may be concluded that much value is attached to this mode of attack. Few people reading the numerous reports of fatal collisions at sea can possibly doubt the terrible and deadly effect of a ram used as a weapon of offence, although opinions may vary as to the possibility of its use and as to the method of attack to be adopted.

Ships of the line, manœuvring as a fleet, cannot alter course and turn in any and every direction with the sole intention of ramming the enemy; if, then, it is

the object of a fleet in action to rely on this mode of attack, it must steer such a course, and be in such a formation as to facilitate the use of the ram on that course, or without diverging to any great degree from it. With single ships the case is different, unhampered by friend or foe the two combatants are free to turn in any direction.

An action between two rams will be one of the greatest tests of strength of nerve, determination, and unflinching daring. Should an officer, in addition to these qualities, possess skill in handling his vessel and the amount of experience which might be gained in gunboats fitted for the purpose of ramming, as has been done in Russia, his value as Captain of a ram in a fleet action would be priceless.

What iron nerves, what cool-headed determination, what almost instinctive guidance will be required to steer one of our largest iron-clads, moving at the rate of eight or ten knots, against one of another fleet approaching at the same rate, with the firm resolution of ramming her, should opportunity offer! There will be no prompting, no time to ask advice, no opportunity for further calculation than the eye and senses can command at the moment; the decision must be instantaneous, and immediately carried into effect; the only encouragment being, in the knowledge that the enemy's ship is commanded and guided by a man undergoing the same fearful test, and that the most

determined man of the two, if sufficiently skilful, must secure his object.

THIRDLY, WE HAVE NO EXPERIENCE OF TORPEDOES IN FLEET ACTIONS. The 'Harvey' torpedo is the weapon supplied for use at sea; but whether it is intended to be worked in special ships or in vessels of the line, is an open question.

I am of opinion that with the present mechanical arrangement of exploding on contact, they are *far too dangerous* to be used in a line of battle. Ships cannot manœuvre with such accuracy—in the excitement of approaching an enemy—as to ensure their not nearing each other sufficiently to endanger their existence by fouling a friendly torpedo.

Torpedoes will be of immense service in warning off rams; and if Captain Harvey's could be exploded by electricity they might be rendered safe companions to their friends, if not so dangerous to the enemy as at present. Their protection (as we might say) against rams would be invaluable.

Special steamers of very great speed, fitted with 'Harvey' torpedoes and bullet-proof mantlets, and commanded by some of the daring and skilful young officers of the Navy, would create a fair amount of confusion and disorder, by rushing at the rate of *sixteen knots* through the enemy's line just before the general action commenced; and, perhaps, would succeed in running the gauntlet safely and in doing some damage.

For the 'Fish' torpedo, I believe special vessels must also be fitted; but what place they will take in the line-of-battle it is very difficult to decide. So little is known of this infernal machine that it almost seems a pity it cannot be left out of civilized warfare altogether; we must, at least, trust that its evil effect will not, by mistake, be exhibited on a friendly ship instead of on the foe. I am sure that many generous hearts would gladly spare even the foe so dire an affliction. They would be *dangerous enemies to both sides* if let loose in a fleet action.

There is one other weapon,—used, however, only in the boats of the fleet—the 'Outrigger Torpedo.' Some experiments have been lately made by an officer of the Channel Squadron with a view to using this weapon when the boat is going at full speed, exploding the torpedo on the beam. Should this prove a success, there is no reason why ships of all sizes should not carry them arranged so as to swing under a ship, passing very close, and exploding when abeam. With the present system of rigging the torpedo out over the bow the boat must be stopped, and is thus placed in a very hazardous position.

Having briefly considered some of the most important weapons to be used at sea, I will lastly consider THE SHIPS TO BE EMPLOYED, AND THEIR ORGANIZATION AS A FLEET.

It has been often remarked, and apparently with much truth, that there will be some difficulty experienced in manœuvring a fleet composed of vessels varying greatly in speed, tonnage, turning power, and armament, so as to develop the special qualities of each ship. If we could only send out a fleet composed entirely of ships of the *Hercules* class, it would greatly simplify matters. As it is now, let us review the fleet of Great Britain and choose from it eighteen ships—worthy champions to fight her battles at sea against any other eighteen the world can produce; still leaving the *Devastation* and her sister-ships to guard the coast.

Let us suppose that England being threatened with invasion by two or more European powers, orders are issued from the Admiralty for the following fleet to assemble at Spithead under Admiral —— and three other flag officers. This fleet, when ready, is to cruize in the North Sea, to guard against the approach of a hostile force.

The fleet will be composed of eighteen iron-clad ships of the line, six cruisers, two despatch vessels, and four special torpedo-vessels. The main body of this fleet—the eighteen iron-clads—will be told off into groups of *three* ships; the groups will be formed into two divisions, three groups in each division; as also into three divisions, two groups in each division, under the Commander-in-Chief and two other

Admirals; the leaders of the three rear groups of each of the three divisions being commanded by the three Captains next in seniority. To make this more explicit, imagine this fleet of eighteen ships to be divided into three divisions of six ships, each under an Admiral; that these divisions are sub-divided into groups of three ships, the fourth ship of each division being commanded by a senior Captain, who will lead the rear sub-division or group. Suppose that the *Superb*, *Hercules*, and *Sultan* are chosen for flag ships, and that the next two ships in each division are the six of the *Audacious* class; these would form the leading groups in each division. Next the *Minotaur* and her two sister ships, as the fourth ship in each division; with the *Bellerophon*, *Monarch*, *Lord Clyde*, *Lord Warden*, *Resistance*, and *Defence*, to form the fifth and sixth ships, completing the rear group of each division. All these ships having been divested of their top-hamper—landing all spare rope and stores—would in all probability be sent to sea with topsails and courses bent: these, with the fore and aft sails, would be all that is required in case of the engines being disabled. The lighter sails, spars, and rigging being disposed of, each ship should carry an extra quantity of coal and be specially provided with towing hawsers.

The squadron of cruisers attached to this fleet we will suppose to consist of the *Inconstant*, with

the flag of a Rear-Admiral, the *Blonde*, *Raleigh*, *Boadicea*, *Volage*, and *Active*: all fast steamers and fully-rigged sailing vessels; their duty being that of reconnoitring and general look-out or 'vidette' work; making prizes of hostile cruisers and obtaining information from them and any other shipping to be met with.

The two despatch vessels would be of the *Lively* class; these would attend on the Commander-in-Chief, being stationed on his beam ready for service.

The position of the special torpedo vessels would probably be in the rear of the fleet whilst cruizing, and on either flank on the approach of an enemy, ready for a dash at full speed if required. At present there are none of these vessels in our Service; but in case of war our mercantile ports could furnish as many small steamers of great speed as would be required. Such is the naval force we might send out to oppose an enemy at a distance from our shores. It is indeed a magnificent fleet, and yet its despatch would in no way drain England's resources. While combining the ships best calculated to act in concert, it leaves a body-guard for our island of the most powerful vessels in the world, and a sufficient number of wooden vessels and inferior iron-clads to protect our trade in all parts of the globe. Having briefly described this fleet, we will now say a few words on its organization.

In the first place, in order that each individual ship should be able to fall into the fleet manœuvring quickly, it is very necessary that she should have been thoroughly tested as to her speed and turning power, under the supervision of her officers. The most essential points to be determined are, (1) Speed at different number of revolutions of the engines; (2) turning power at different speeds; (3) helm angle required to turn on a certain arc, at a given speed. These and other trials should be carefully and concisely tabulated. The Captains of the different vessels, knowing their relative power with that of the flag ship, will be able to maintain position in any formation after a very little actual trial of their ships with the fleet. In the absence of this knowledge it would have to be gained through a tedious number of experiments not beneficial to the fleet in general, and retarding its practice of tactical movements.

The ships having assembled at the rendezvous after their trials, the fleet—having been divided into two, and also three, divisions, and each of the three divisions sub-divided into two groups—will, with the squadron of cruisers and other small vessels, weigh and proceed towards its cruizing ground. This will be the time for the fleet to perfect itself in the manœuvres deemed necessary during, and while preparing for, an engagement; and on the simplicity of these manœuvres and the ability to perform them with facility,

will depend, to a very great extent, the result of an action.

I most strongly advocate the manœuvring of a fleet in groups of *three* ships. Whether in single column, column of two or three divisions, in line ahead, line abreast, or line of bearing, still always in 'groups.' Groups once having been formed the ships should not be changed—the great object of groups being that each ship, by constantly holding the same place, will get to know its position and the movements of its companions in the group; by this plan the comparatively few manœuvres that are required (when working in 'groups') will be taught to eighteen ships in six groups as easily as to six ships not grouped.

Having been well practised in changing from one formation to another and in changing direction—or, in other words, having had a week's steam tactics in 'groups,'—we will bring the fleet into action.

On sighting the enemy, the formation in which it is intended to attack must at once be completed; the Commander-in-Chief's flag-ship altering course towards the opponents, and the remainder taking up position on the new course by increase or decrease of speed. Having headed towards the enemy, there are, I think, when working with groups, only two formations in which to place the fleet for attack, viz.: *Groups in columns of two divisions in line ahead* and *Groups in line*

abreast;—the former if the enemy exposes a small front, the latter if an extended front.

In order that the whole fleet may be prepared, and that each Captain may know what is required of him, it would be advisable that four, or any larger number of plans of attack be made out and explained beforehand, so that some one may be applicable to the various circumstances of position and formation, under which the enemy may be sighted. These, with the following two rules for the guidance of the groups, should be sufficient to make every Captain's duty clear.

> 1st. The ships of a group will work together, under the immediate direction of their leader, who, when the action has commenced, will, at his discretion (and by means of the first four numeral flags at his peak), alter its formation.
>
> 2nd. Groups will keep well clear of each other, and will preserve as nearly as possible their distance and bearing from the Commander-in-Chief, or leader of their division.

As it will be impossible to understand complicated, or even any but the most simple signals in action, I should propose that the plan of attack (as above) having been decided upon, and communicated to the ships, and the fleet having been formed ready for the encounter,—the only signals to be made, should be what would be

termed, "Action Signals." I can see no necessity for these being more than the compass signals (combined with the divisional flags, if necessary to refer to a certain division); at the fore, those denoting the Course; at the main, those denoting the Line of Bearing—always referring to 'Groups.' After passing clear of the enemy, the mizen might be used to signalize the detaching of ships or groups in support of disabled comrades and to capture disabled foes.

Approaching in column of two divisions an enemy's fleet exposing a small front, the object will be to make it pass outside your nearest (say the first) division, that division exchanging broadsides and moving directly ahead, keeping all the enemy's ships well enveloped in smoke and doing all the damage it can with guns. In the meantime (or directly the leading ships meet), the other (or second) division having been previously instructed, will turn eight points towards the first division, and, in column of groups in line abreast will pass astern of the first division and charge the enemy along its whole line, before it can have recovered from the effects of the first encounter; this is the time to use the rams.

In these days of high speed, when it would be fatal to a squadron to stop or go slow, the old difficulty of breaking the line can no longer exist. Two fleets, therefore, approaching each other with extended fronts are bound to pass through, making the best use of

their guns in passing, the rams not coming into use unless an opponent swerves from his course. In this mode of attack the fleet that can maintain the most perfect order, and when through can re-form and again be led against the enemy, must gain an important advantage, as it will be in a position to overtake the enemy in confusion, or in the act of re-forming. The first fleet re-formed may be able to carry on the battle, clear of the wounded by the first charge, and by manœuvring cut off the enemy's ships, and by detaching a group after them, oblige them to strike their colours. The remainder of an action carried out in the spirit of Nelson's day would resolve itself principally into trials of individual skill; an immense advantage resting with the fleet still retaining order.

In concluding this sketch, I will condense my general ideas on preparing a fleet for battle into two fundamental principles. 1. In selecting weapons for service with a fleet, choose those that are capable of inflicting the greatest possible injury on the enemy, with the least possible danger to yourself. 2. In the organization, manucœvring, and formations of the fleet, and in the use of signals, study the utmost simplicity, arranging everything with a view to efficiency combined with the fewest prospects of damaging friendly ships.

CHAPTER II.

THE VARIOUS ELEMENTS CONSIDERED IN DETAIL.

IN this chapter, before referring to the weapons that are at present carried, and their special uses, it will be as well to review the present and proposed organization of the fleet that is to carry them, and to minutely inquire into the system of manœuvring, tactics, and strategical formations of squadrons and fleets as applied to a Naval action.

FIRST.—ON THE MANŒUVRES OF INDIVIDUAL SHIPS.

At present, when a ship is commissioned, or sometimes before, she undergoes various trials of speed, turning power, and other tests of her engines; these trials are carried on under the superintendence of officers of the Steam Reserve and heads of the Engineer Department, the vessel being generally in the hands of a pilot. If already commissioned, the officers who will eventually take charge of the ship have, during these trials, little or nothing to do with her management, and consequently rarely gain much information thereby. After these few trials, or perhaps—

the ship having been previously tried—immediately on her being reported ready for sea, and with the newly-assembled officers strange to each other and to their ship, she may be ordered off to join the fleet with all despatch. This allows no time for the officers to make themselves thoroughly and practically acquainted with the powers of their vessel.

I think it is advisable and important that these trials should be carried out more under the immediate supervision of her own Captain assisted by his own officers, especially if the ship in question is about to join a fleet, and that after having satisfied the authorities as to the correctness and serviceable working of her machinery, etc., the ship should, under them, be thoroughly tested in all her powers. A few days would suffice in which to gain a great deal of knowledge, tabulating it for future reference under such headings as these:—

1st. Speed at various numbers of revolutions of the engines.

2nd. Greatest turning power at these various speeds, and from a position of rest. By *turning power* I mean the diameter of the circle on which the ship turns; the time in completing half a circle should also be noted. With any new or special steering gear, or rudder, further trials should be made.

3rd. Time in which the ship can be brought to a condition of rest by stopping and then reversing the engines at various speeds. A thorough knowledge of the power of stopping would save many cables being strained or parted, and possibly an occasional collision.

4th. The amount of helm required to turn at a certain standard speed, on a certain standard arc. By a standard speed I mean that rate of steaming attainable by all ships of the line, laid down from time to time as the speed at which a fleet would go into action—at present, probably, eight or ten knots. By a standard arc I mean the arc of a circle of a certain diameter, the power to turn on which at a standard speed (say ten knots), is attainable by all ships of the line. At present, including the ships of the *Minotaur* and *Warrior* class, this diameter would be five cables. Excluding these unwieldy vessels, it might be reduced to three and a-half or three cables, and in future perhaps still less; but I do not imagine it is advisable to reduce it too much, and to oblige ships to use all their helm in turning.

It would be of the greatest advantage in fleet manœuvring to have obtained this standard amount of helm. Speed would make little or no relative difference with ships of ordinary dimensions; all such ships giving their manœuvring amount of helm would turn on equal circles, larger or smaller than the standard, according as the speed is greater or less (it has been proved that with ships of the *Minotaur* class, this does not hold good). Suppose fifteen ships, in five divisions, in column of divisions in line abreast, a signal is made, "*Alter course eight points to starboard*," how easily would the ships swing round and find themselves in column of divisions in line ahead; or even sixteen points might be attempted by a fleet in this close formation, without the present danger of fouling, caused by ships not turning on equal circles.

Captain Colomb recommends that all ships should turn upon the same circle. He notices, also, how much better it is to manœuvre a fleet by the helm only, than by the speed. This is strongly advocated by Captain Pellew.

The sailing powers of ships that lift their screws might be more thoroughly tested in newly commissioned ships; all practice in such seamanship being of the greatest value to naval officers.

The Captain, who has so tried the value of his machinery and rudder—the results being tabulated for reference—will feel more confident in his charge, and

more at home on joining the squadron to which he is attached.

As I consider "Squadrons" to be part of a fleet, they will be referred to under that heading.

SECONDLY—AS REGARDS "FLEETS."

In order to explain the formations advocated as the best in which to take a fleet into action, it will, I think, be necessary to review the arguments for and against the different formations laid down for our use, and at present in practice.

Captain Colomb, in a lecture at the United Service Institution, sums up these formations under four headings, viz. :—

1st. An extended front, with small depth.

2nd. A narrow front, with great depth.

3rd. A mass or square, where depth and front become equalized.

4th. A system of groups, disposed in various manners; the principle being that the attack or defence is not concentrated, each group making itself felt as occasion offers.

This is a very good summary of the 'modes of attack,' but the details must be considered more closely. The manœuvring included under the last heading, appears greatly to disparage the system of 'Groups.'

We will commence with a few remarks on the organization of the fleet :—A fleet will consist of any

number of ships, from twelve to twenty. Each ship on arrriving will be given its fleet number; the fleet will then be divided into two divisions,—the first half (according to their fleet numbers) composing the first division; the remainder the second division; also, perhaps, into three, four, or five divisions, according to circumstances; the rear ships of each of the two divisions will form a third division; to form four or five divisions the ship must be specially chosen, it being necessary that each be led by a senior officer. When in two or three divisions, sub-divisions may be formed, each consisting of half a division.

A very excellent example of this plan was worked out last summer, when a combined fleet of fifteen ships assembled for practice in steam evolutions under the Admiral commanding the Channel Squadron. The fifteen ships were divided into two, three, and five divisions, the two and three divisions being again sub-divided. This number is not easily dealt with, but was admirably handled by Admiral Hornby. The ships receiving their numbers were so arranged that, when in two divisions, numbers as high as eight formed the first division, the remaining seven (from 9 to 15) formed the second division. Number 5 ship was third in command, and with 6, 7, 13, and 14, formed the third division when the formation in three divisions was ordered. When in two or three divisions

PLATE . I.

FORMATIONS OF THE COMBINED FLEET 1872

FIG. 1.

In Two Divisions.

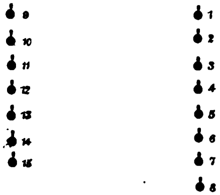


FIG. 2.

In Three Divisions.

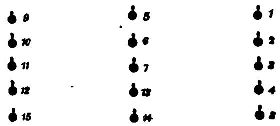


FIG. 3.

In Four Sub divisions.

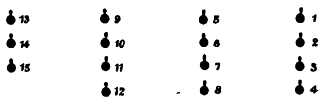


FIG. 4.

In Six Sub divisions.

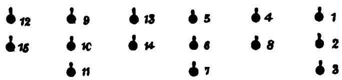
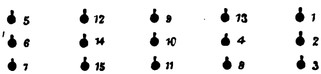


FIG. 5.

In Five Divisions.



ROBT J COOK & HAMMOND LITH. BROADWAY, WESTMINSTER

sub-divisions could be formed, the rear half of each division (being led by the two or three officers next in seniority) forming the four or six sub-divisions. Five divisions were formed as follows:—first division, 1, 2, and 3; second—13, 4, and 8; third—9, 10, and 11; fourth—12, 14, and 15; and fifth—5, 6, and 7. This organization of the fleet will be more readily understood by referring to figures 1 to 5, in Plate 1. It will be observed that the seniority of the ships is the first consideration, and it requires ingenuity to arrange a fleet, so as to readily form in five different formations. With the above fleet numbers, 1, 9, and 5, were flagships; and 12, 13, and 4, were the three next in seniority. I believe that this difficulty would, to a great measure, be overcome if the 'Group' system were thoroughly introduced.

Let us suppose the fleet above described is sent to sea for evolutionary purposes with orders to practise all the manœuvres the signal book contains. We might divide these into five series.

As a rule, when not practising steam tactics, the fleet will be in column of two divisions in line ahead, in open order; divisions sixteen cables apart, or less.

The first series of evolutions to be practised are those performed without altering speed. The fleet, in two columns, sixteen cables apart (or three columns, ten cables apart), the ships being in close order, at two cables distance, would be exercised in forming:

(1) columns of divisions in line abreast, and back to original formations; (2) columns of sub-divisions in line ahead, and then to line abreast; (3) from any of the above to single column in line ahead or abreast and back again. All these are excellent and very necessary movements, and if well performed make a very pretty and interesting spectacle; especially if by making double signals the columns are altered, without the rear ships (on which the formations are made) changing their course. This has been practised lately in the evolutionary squadrons under Admiral Hornby. Nothing could so thoroughly impress on the officers the power of speed and helm, as to see and themselves handle the huge machines of war moving at the rate of ten knots in these simple evolutions. It would be a great advantage to such officers, if, on occasions of well practised fleets meeting, manœuvres were (once or twice) performed at this speed.

The second series would be the above manœuvres performed by alteration of speed, or rather some of the less complicated of the above; the leaders, as a rule, holding their course, and the remainder forming on them.

The third series of evolutions would be the formation of columns, single, divisional, or sub-divisional, in *lines of bearing*, in *double quarter*, and *bow-lines.* Lines of bearing are, of all formations, the most easily practised, having the advantage by being ordered by

the single signal *alter course,* and by being performed by a single movement of the helm. They would be used whenever the fleet was required to move to starboard or port in a diagonal direction to avoid a danger. Quarter and bow lines, both single and double, have, I think, no special advantage, being unwieldy formations; they are thus spoken of by Captain Colomb in his "Lessons from Lissa," R.U.S.I. Journal, Vol. XI., page 114. " In my former paper I " endeavoured to point out that however valuable " in theory as an attacking formation this angular " figure might be, it was so unwieldy and difficult to " maintain, that practically it was valueless; since I " gave that opinion, I have had opportunities of " making experiments in an actual fleet, with the " fullest confirmation of those views." Captain Pellew in his lecture on Fleet Manœuvring (at the same Institution) expresses unfavourable opinions of double lines of bearing. A formation of the same nature as *indented lines* would be serviceable for attacking or bombarding forts, but would not be used in a fleet action.

The fourth series of formations would be those in 'threes,' 'fours,' and in 'groups' (this latter having been adopted and entered in the signal books of the evolutionary squadron by order of the Admiral Commanding). The introduction of the 'group' formation quite does away with the necessity of the other two.

On looking through the signal book it will be observed that there is more than one method of performing most of the evolutions, and that there are several formations which admit of a fleet presenting to an enemy an extended front, a narrow front, or other forms. Now, I think it obviously intended that each Commander-in-Chief should, at his discretion, practice such of these evolutions as he may consider desirable for the perfecting of a fleet in all the manœuvres required for a naval action. Men of formed opinions must be permitted the option of working out their principles their own way, and would, in naval tactics, do so to a far more serviceable end than could possibly be attained if cramped and hampered for want of signals.

In the French "Tactique Navale" of 1857—a book translated by Captain Phillimore,—groups of four ships are thus spoken of: "In each, the ships are "grouped in the rear of, and round their Admiral, "without any condition of order except keeping "themselves on the right or left according to their "position of right or left in line abreast." Captain Pellew makes no reference to them in his lecture on Fleet Manœuvres, in May, 1867, but referring to the six sub-divisions into which he proposes to divide his fleet, he remarks in Vol. XI., page 529, R.U.S.I. Journal: "This system of cutting up large fleets into smaller "bodies, so much more easily manœuvred, I consider

" to be of essential importance, especially with respect " to the facilities it affords for rallying or detaching, " and for keeping ships together at night." Admiral Hornby appears to have been the first to lay down any concise system on which to arrange ships in groups, although Sir Thomas Symonds introduced them in the Channel Squadron, and the practice of that system with our fleet may be considered in its infancy.

The fifth and last series would include the *Changes of course of a fleet in various formations; Inverting columns;* and *Changing position of columns.* This sums up generally all the evolutionary signal book. Changes of course are often necessary in conducting a fleet; but, as the correctness and quickness of such changes may be at times of the utmost importance, this as an evolution should not be forgotten, especially when moving with an extended front. The other movements are of less practical importance, as it is not probable that they would be performed in the presence of the enemy.

I have before said that I most strongly advocate the system of 'Groups,' as admitting of the arrangement of a fleet in the most compact and manageable formations. I will, therefore, endeavour to bring forward arguments in its favour which will prove its superiority to other systems in either attacking a fleet or fortress, defending a convoy, or performing any

other service. It must also be understood that I advocate the adoption of this system in its entirety, in which case I would venture to suggest that two-thirds of the present evolutions would become obsolete.

I imagine a fleet to have assembled, consisting of from twelve to twenty ships. Each ship on arrival has been told off to a certain 'Group,' as either No. 1, 2, or 3, of that group: this being equivalent to her fleet number. The fleet would in this manner be divided into groups of three if the number of ships comprising it is a multiple of three; if not a multiple of three, either one or two groups will be composed of only two ships, and the remainder three. Thus, a fleet of sixteen ships would make six groups—four of three ships and two of two ships; a fleet of seventeen ships would make six groups—five of three ships and one of two ships. It would in some cases be advisable to detach a vessel of inferior power to the others, so as to have a more convenient number to divide. The groups having been formed, the fleet will be divided into two, and, perhaps, also three divisions, each division consisting of two, or three, or four groups.

I will now explain the system I propose of arranging the ships in a group. I would suggest that there should be five formations in which a group can move; that these be ordered by means of the first four numeral flags; and that in each, No. 1 ship will invariably lead its group. Plate II, Figs. 1 to 5.

PLATE II.

GROUP FORMATIONS.

Scale 4 Cables to an Inch.

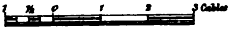


FIG. 1.
Formation 1.

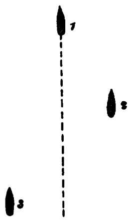


FIG. 2.
Formation 2.

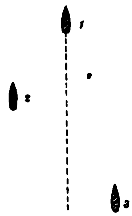


FIG. 3.
Formation 3.

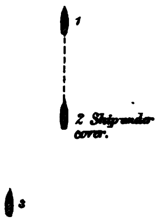


FIG. 4.
Formation 4.

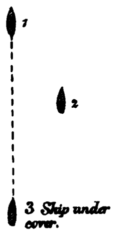


FIG. 5.
Formation 5.

GROUPS USED IN THE CHANNEL FLEET

FIG. 6.

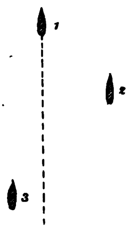
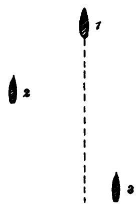


FIG. 7.



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Formation 1 (Fig. 1).—At the signal, Numeral 1, to the groups, ship 2 will form five points abaft the starboard beam of ship 1, and two cables from her. Ship 3 will form six-and-a-half points abaft the port beam of ship 1, and four cables from her, being then four points abaft the port beam of, and three cables from, ship 2.

Formation 2 (Fig. 2).—At the signal, Numeral 2, to the groups, ships 2 and 3 will form on ship 1 as above, only on opposite quarters. Ship 2 on port quarters, two cables distant; three on starboard quarter, four cables. These two are the principal formations in groups. They differ slightly from those laid down by Admiral Hornby, the bearing he adopted being for No. 2 ship, four points and two cables distant; No. 3 ship, 7 points abaft the other's beam, and three-and-half cables distant.—See Fig. 6 and 7.

Formation 3 (Fig. 3).—At the signal, Numeral 3, to the 'groups' (in formation 1, 2, or 4), No. 2 ship will move into the wake of No. 1 ship, preserving the same distance from her, viz., two cables.

Formation 4 (Fig. 4).—At the signal, Numeral 4, to the 'groups' (in formations 1, 2, or 3), No 3 ship will move into the wake of No. 1 ship, preserving the same distance from her, viz., four cables.

Formation 5 (Fig. 5).—At the signal, Numerals 3 and 4 combined, to the groups (in any formation), ships 2 and 3 will move into the wake of ship 1, still

preserving their distances, and moving on in line ahead. These last three formations would be performed by a slight movement of the helm. In case of a severe attack on one or both vessels, either or both can be called under cover. Formation 5 would be very much used in passing through narrow channels, in anchoring, and on various occasions. A fleet in single column of 'groups,' each 'group' in formation 5 would be simply a single column in line ahead. It will be observed that in each of the above formations, the distance of the leader from No. 2 ship is two cables, and from No. 4 ship four cables; this will facilitate their keeping station; the bearings being marked on the compass bowls, and with pointers in various convenient places, the rear ships would be enabled to maintain their positions with great ease.

Let this fleet, formed and organized on the system of 'groups,' be sent to sea to be exercised in the evolutions required to perfect it in all the formations necessary for war service. The fleet will, when not at exercise (in steam tactics), sail in two divisions, the groups in formation 5, as a rule, at night; being altered to formation 1 or 2 during the day for the purpose of practising the officer of the watches in keeping station. In ordinary cruising the 'groups' may be at any ordered distance apart; but when arranged for action (or evolutions), I should propose that

the leaders of 'groups' be eight cables apart; this would extend the line a little more than at present, ships now being two cables apart; it would also necessitate the columns being eight cables apart for each group in the longest line, instead of two cables for each ship in the longest line, as at present; but the most important object of the 'group' system, that of keeping the groups well clear of each other, would be sacrificed if the leader of one group was only two or two and a-half cables from the rear ship of the group next ahead.

In all the evolutions spoken of as being performed without alteration of speed, or in other words by square movements, it will be observed that (unless the order of the fleet is to be reversed) all the ships continue to turn eight points in one direction (say to starboard) off their course, and then eight points the other way (to port), to renew their course in the new formation. This is the case in every change, as long the fleet retains the same order as is shown in Plate I, Fig. 1. When working with groups, therefore, it being necessary that they should be able to turn without losing order, I would arrange them as follows:—If the turning to move into the new formation is first to starboard and then to port, the No. 2 formation of groups must be formed by all the groups; the leaders will then have to turn towards their rearmost ship (No. 3). In Plate III, Fig. 2, a group is shown turning first eight

points to starboard off its course, then to its course again; it will be observed that by arranging the two rear ships at a bearing of four points from each other, if the leader turn first eight points, and then these two (rear ships) turn together, when No. 2 ship is astern of the leader, (now on his new course,) their order will be temporarily changed, 2 becoming 3, and 3, 2; but they will still be in perfect station as a 'group' in formation 1; on turning again after their leader into the original course, they will again resume formation 2, as if nothing had happened. This is the mode of turning groups from and to a standing course that I advocate for all square movements; and it would soon appear simple to the officers commanding the ships of a group accustomed to work together. It is the only complex piece of manœuvring in the whole working of groups. Formations 1 and 2 differ from those of Admiral Hornby only with a view to this mode of turning, the rear ships being, by my plan, at equal distances from the wake of their leader.

The groups composing this evolutionary fleet having been instructed in the mode in which they are to turn, will be exercised in forming *single column of groups in line abreast* and back to *column of divisions in line ahead*; perhaps to *columns of divisions in line abreast* and back; also to *single column in line ahead* and back. Then the fleet would be exercised on lines of bearing from their divisional leaders, or from the

PLATE III.

A FLEET MANŒUVRING WITHOUT CHANGING ORDER

FIG. 1.

From Column in 2 Divisions
to Column in line abreast
to Column in line ahead
to Column of 2 Divns in line ahead

Scale 16 Cables to an Inch.

4 2 0 4 8 12 16 Cables

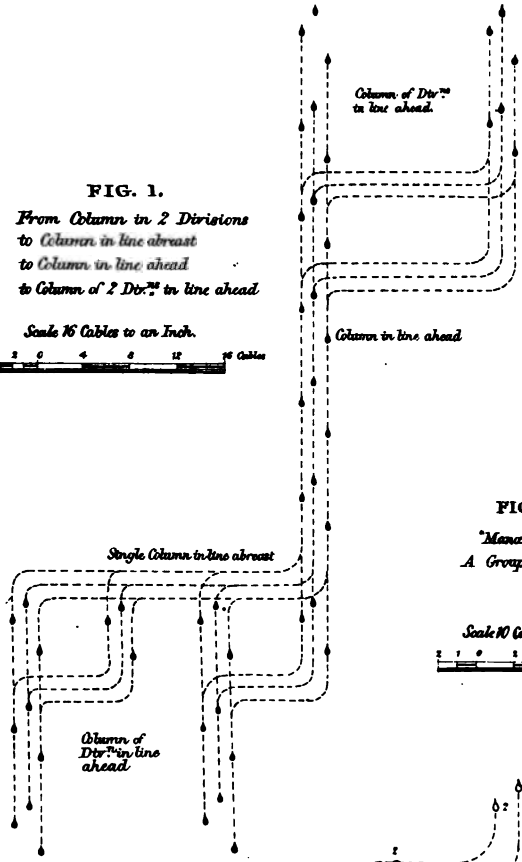
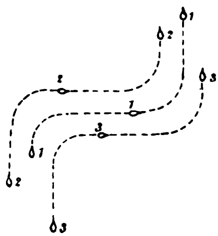


FIG. 2.

"Manœuvring."
A Group "Turning."

Scale 10 Cables to an Inch.

2 1 0 2 4 6 8 Cables



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Commander-in-Chief alone. Practice in keeping correct station on lines of bearing is of immense importance, being, in my opinion, the only formations that could be used when once an action is commenced. After this the fleet should be thoroughly exercised at changes of course when in various formations. Groups, in changing course, will not change their formation, but the rear ships, by alteration of speed and course, will preserve their station in the group. Changes of course cannot be too much practised, as, having passed by or through the enemy, the groups would have to be turned in the opposite direction, in order to make a second attack. Of course, in all the above manœuvres, groups are maintained, and the former, few as they are, include all that are required.

I now ask if eighteen ships in six groups could not be instructed in the above few evolutions as easily as six ships not grouped in the many evolutions at present laid down for the exercise of our fleet? All such formations, as threes, fours, indented lines, double bow and quarter lines, are formed for the 'group' system; columns of divisions, or single column in line abreast, being superseded by columns of groups in 'three' formations, which would admit of the ships abreast of each other being eight cables apart instead of two, also of the rear ships being in a position to use their ram bows, if an opportunity offers, without endangering the ships next to them in their line.

I compare, in Plate IV., Fig. 1 to 3, the 'group' formations in column of divisions in line ahead, and in line abreast, with the ordinary formation of an equal number of ships acting singly. In Fig, 1 extended fronts as opposed to each other; Fig. 2 narrow fronts; and Fig. 3 other formations.

So much for the evolutions to be practised. We will now bring our fleet into close action, and test the advantages of the 'group' system in a naval engagement. Before actually taking it into battle, there are two questions of vital importance to be considered: 1st breaking the enemy's line; 2nd, the signals to be used in action.

On the much disputed question of breaking through the enemy's line there are great differences of opinion. In the days of our gallant forefathers—those rulers of the seas in their sailing ships—to break the enemy's line and cut off a portion of his ships, out-manœuvring the remainder, and preventing their rendering assistance to the portion cut off, was to make prisoners of these last. How different in the present day! What an opportunity for the rams if the enemy (as in earlier times) present their broadsides in a close line ahead, or, as at Trafalgar, a line so close that the ships overlapped, to prevent the English from cutting through. I believe, therefore, that no such plan will be adopted by steam fleets; but that both will take the offensive and approach bow to bow.

PLATE IV.

DIFFERENT FORMATIONS OPPOSED TO EACH OTHER.

Scale 16 Cables to an Inch.

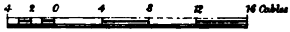


FIG. 1. *Extended Fronts.*

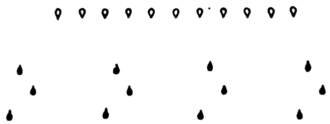
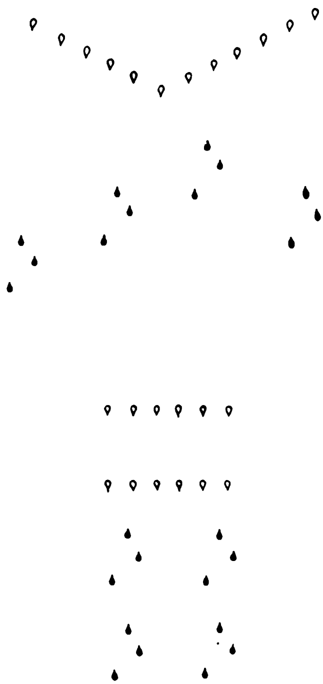


FIG. 2. *Narrow Fronts.*

FIG. 3. *Other Formations.*



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A writer in the *Edinburgh Review** says:—"But "whichever (formation) finds most favour, there is "little doubt that the attack itself, indeed, that the "whole combat, will consist of a series of rapid "penetrations of the enemy's line. Each side will "be equally an attacking party." There are few people who do not deem this a probable result. For myself, I not only hold that it is impossible to prevent a line being broken through, but I imagine that it will be found that a group of three vessels can pass through an extended line of the enemy's ships with very little more chance of damage than if accompanied by the whole fleet, which we have supposed equal in number to that of the enemy. Ships of a fleet cannot suddenly be concentrated on a certain spot; at the rate at which they are closing with the enemy, the slightest divergence from the pre-arranged plan would cause a vast amount of confusion. It may be granted, that if one of the group is disabled, the enemy could capture or sink her without her friends being able *to draw the battle clear in time;* but where the friendly fleet is at hand, the charge of a single group through the enemy's line would carry with it very little risk, for the 'Group' would be quite unhampered, whereas, in the enemy's line, the safety of each ship would depend to a great extent on the movement of her associates.

* No. 278, page 587

I am now supposing a 'group' to have become separated from the Fleet, either by accident or in obedience to orders. I do not admit as necessary that absence of formation suggested by Captain Colomb when, speaking of this system, he says—"The principle "is that the attack and defence is not concentrated, "each group making itself felt as occasion offers;" but I maintain that one or more groups in regular order would, in penetrating an enemy's line, be more capable of inflicting injury, of supporting each other, and of obtaining the required result—"penetration without loss of order," than any other formation.

On the use of signals in action, we find a variety of opinions; their use, to any great extent, is very generally condemned. I believe it is left to the various Commanders-in-Chief to introduce special signals for the fleets under their command, so that their particular plans may be readily transmitted to the ships. No doubt in the event of war some simple system would be introduced by which to preserve order in the fleet when in action; since, however possible it may be to see flags, to appreciate their meaning at sight is another and most important thing. The plan, therefore, of action signals I would suggest as the most feasible, is this: that, while closing to engage, and during the action, the compass signal of the course to be steered be kept hoisted at the 'fore,' and the bearing of the divisional leaders, or all group leaders, from the

Commander-in-Chief, at the 'main.' Divisional flags to be used when referring to divisions. The groups to follow their divisional leaders, and all general signals to refer to 'Groups.' The mizen would be available for signalizing in the usual manner when clear of the enemy, ordering the detaching of groups, etc. Groups will at all times preserve their distance apart. By this plan it will be seen that all the groups are placed in order by two signals, which can constantly be referred to and understood at sight. Captain Pellew, alluding to signals in his lecture on Fleet Manœuvring,* writes—" One of the most common objections one hears " is, that in the smoke and excitement of action every " Captain would have to act as his judgment directed, " and all these signals would be of no use, forgetting " that the movements before a battle are often more " influential, as to its results, than the actual chances of " the fight." Again referring to signals in action, Captain Pellew, supposing that, owing to complicated manœuvring and a want of simplicity in signals, the Admiral finds his fleet in some confusion close to the enemy, says— †" Then you find that, smart as your " signalmen are, the signals cannot be made smart " enough; eventually the poop gets enveloped in flags, " and the men look nearly as puzzled as you do. Then " the ship leading seems to have forgotten to apply her " deviation. You try more signals, but the end is

* U.S.I. Journal, Vol. xi., page 531. † Page 540.

"come, time forbids further changes; in despair you "whip up the final signal for action, clap on full speed, "and trust to luck and Providence!"

I think that the simple plan of manœuvring in 'Groups,' which the Admiral may place in any position by two signals—one at each mast-head—would obviate all the difficulties referred to by Captain Pellew, and the Signal Department might work the flags from the main deck.

As a conclusion to my argument in support of the system of 'Groups,' I will endeavour to picture the manœuvring during a naval engagement between two fleets of equal strength, and handled with equal skill, but working on different principles. For convenience, we will designate a fleet formed in groups, Fleet I.; in the ordinary column of divisions in line ahead, Fleet II.; in single column in line ahead, Fleet III.; in single column in line abreast, Fleet IV.; and a fleet formed in two or more columns in line abreast, Fleet V.

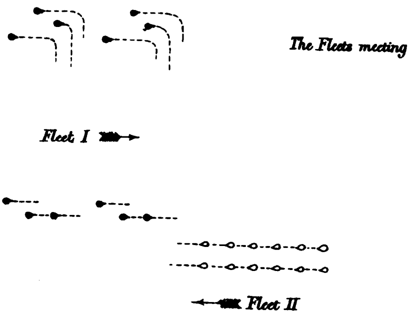
It is generally admitted that a fleet will have little or no time to make complicated changes of formation when once in sight of the enemy. On this point I claim a strong advantage in favour of the 'Group' system, but we will now waive this question and suppose the fleet to have completed their formation before coming in contact with each other.

Let us suppose Fleet I., in columns of groups in two divisions in line ahead, opposed to Fleet II., in columns

PLATE V.

Fleet I in Groups versus Fleet II in Columns of Divisions in line ahead closed to 2 Cables distance.

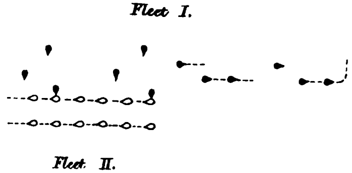
FIG. 1.



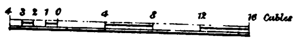
N. B. The dotted line represents the Course to be followed.

FIG. 2.

Charge of the Port Division of Fleet I.



Scale 16 Cables to an Inch.



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of divisions in line ahead (Plate V., Figs. 1 and 2.) Fleet I. observes Fleet II. four points on the starboard bow of the Commander-in-Chief who leads the starboard division. The course is altered at once by signal to the required direction, say—North, toward the enemy, and Fleet I. observing that Fleet II. exposes an equal front, does not alter its formation; Fleet II. closes its columns to four cables and proceeds at full speed, its ships two cables apart in two columns in line ahead; general orders having been issued that all ships will follow their leaders at all risks, and keep close to their next ahead. This is Captain Colomb's plan of attack, but in explaining its merits* he adopts for its opponent a formation of which he afterwards speaks thus, "It will be seen that I believe the extended front to be a weak formation, and in no case should it be taken up in an attack." Fleet I. has previously arranged that if the enemy advances with a narrow front (as is the case with Fleet II.) the first division will attack by passing along the enemy's line, keeping outside it if possible; and the second division will charge the enemy, turning towards the first division as the leading opponents meet, so as to come in contact astern of the first division just as the last ship of the enemy is clear, and before they can have recovered from the first attack. If, then, we suppose that the enemy, in ignorance of this plan, should pass along the first division on its outer side, it

* U.S.I. Journal, January 15th, 1872.

would afford the second division a glorious opportunity of trying their ramming powers (Fig. 2). Should, however, Fleet II., by altering course, manage to pass between the two divisions, the second division still might charge, but their charge being of course more conspicuous to the enemy, they would be better prepared for the attack.

The groups which compose the first division of Fleet I. will turn sixteen points to port as they clear the enemy in succession; the second division of Fleet I. will turn together to port when through or clear of the enemy's line, and then again sixteen points to port in succession, forming, if in time, and in fair order, on the port beam of the first division, otherwise, astern of it. The Commander-in-Chief will hoist at the fore the signal '*South,*' (the course); and at the main, either '*Second division, East,*' or the general signal '*North,*' according to the position in which he finds the second division. All but the exact course will have been previously arranged.

Fleet II, when clear, will still follow their next ahead; and if they have passed without their line being utterly broken, they will naturally turn again towards their opponents; who, we have seen, have re-formed, and are ready to repeat the first evolution.

Let us consider the chances on either side. The first division of Fleet I, in which the starboard ships of each group will probably have been formed under

cover, will exchange broadsides with the nearest division of the enemy. Passing, possibly, at the combined rate of twenty knots, they would have a slight advantage, as the objects to be fired at would be at regular intervals, and also in two columns. The leading ships will no doubt fare the worst,—they should therefore be the strongest; but let us suppose that, with the help of speed and smoke, none of the ships are so damaged as to be prevented from proceeding on their course. In Fleet II. the line, though none of the ships are severely injured, becomes somewhat irregular, some ships easing or stopping their engines, to prevent collision with next ahead, etc. Suppose all have passed comparatively unharmed. Now comes the rush of rams; "the 2nd division of Fleet I. at the Charge." What can Fleet II. do? Take one of its *leading* ships for instance. If she is rammed, the remainder in rear are immediately in a heap: if she tries to avoid the ram by turning away, she runs into the other line; if she turns towards the ram (her only chance of safety) she breaks her line, and causes its disorganization, finding herself at the same time opposed to a group of three ships supporting each other. If the second division were brought to the charge with the same spirit of daring and resolution that was displayed at St. Vincent, the Nile, and Trafalgar, it would, I believe, so utterly break and throw the enemy's line into confusion, that little more would be required to complete the victory. Of

course this could not be done without a very great risk to the ships charging, and men cannot be always expected to be equal to such an occasion; but let the group leaders only be bold men, persuaded that by leading their groups undauntedly against the enemy they are doing their duty, and victory will be the result. Should they, however, be unwilling to accept the responsibility of thus bringing their ships into contact with the enemy, no results could be expected, and their next endeavour would be to re-form on the 1st division. In neither case would the enemy, under such orders as we just now explained, be able to use their ships for ramming, as it is impossible to ram in close line ahead.

I would conclude this sketch of an engagement by claiming that 'victory for the groups is merely a matter of time,' unless some unaccountable accident occurs to demoralize the fleet, such as the sinking of the Commander-in-Chief, the blowing up of a ship or or two, or some catastrophe equally appalling, and at the same time visible to the fleet.

Captain Colomb in a summary of his ideas on the attack and defence of fleets says,* "It will be seen "that I lay great stress on compactness and concentra-"tion in attack, and I am in consequence opposed to "systems of reserves of separate fleets acting con-"jointly, or lastly, to the attack and defence in groups."

* Vol. xvi., page 15, U.S.I. Journal.

I agree with him as to the desirability of compactness; and in themselves the groups should be compactness itself; but on this one condition, that each ship should be in a position to use her various weapons with effect. Concentration of ships is dangerous work. Captain Pellew speaks of closing heavy ships as "a difficult manœuvre." Ships in *Close columns* are not free to use either guns or rams to advantage. If any of the leading ships are disabled when the engagement is pretty general, the whole column in rear is at once thrown into confusion, the ships running over each other, etc. I cannot but fancy that the great object to be obtained is to strike the enemy's line as often and as hard as you can, at the same time keeping your fleet so arranged as to prevent any possibility of the ships being in each other's way and hampering their movements. Captain Colomb, again referring to 'Groups,' says: *"I cannot at present see how, when "fleets are at speed, a 'group' can act independently "without running the great risk of finding itself "surrounded by enemies and beyond the support of "its friends." I must acknowledge that my views on these points are directly opposed to Captain Colomb's. If on the same course, however independent the 'Groups' are of each other, they cannot well be beyond the support of their friends; and as for the enemy surrounding a 'Group,' I cannot conceive it possible

* In U.S.I. Journal, vol. xvi, page 15.

as long as a high speed is maintained, unless they (the enemy) follow *en masse* the course of a refractory 'group' and overtake it, by doing which, they would themselves be thrown into a terrible state of disorder.

We will next consider briefly the battle fought between Fleet I. (as before) and Fleet III. in single column in line ahead, a formation which might be used with a small fleet, but one necessarily loose and straggling. In this case, Fleet I. should act in the same manner as in the last engagement (with Fleet II.), except that since the single line is double the length of its first division, that division would be ordered to turn and charge when the leading ship was nearly abreast of the enemy's rear, getting through as best it can and re-forming as before. There is little likelihood of a formation, such as that of Fleet III., being used in an action; rams could in no way be prevented from piercing it, and I am afraid its prospects of success would be very slight.

Next, we have opposed to Fleet I. an enemy with an extended front—Fleet IV. in single column in line abreast; Fleet I., after altering course to the required direction, will at once be formed in column of groups in line abreast—groups eight cables apart. Thus we have two similar formations opposed to each other. They meet. The 'groups', rushing on the enemy, lose no opportunity of using either ram-bow or gun; the ships of the extended line, unable

to fire without endangering their next abeam, and unable to swerve from their course and use their ram, would surely fare the worst. Should the line of groups overlap that of the opponent, the flank group, finding it would pass clear by preserving its course, will (having been previously instructed) turn eight points towards the enemy's flank ships, so as to charge them. To do this, it must turn just before the enemy's ships bear four points on its leader's bow, and charge, passing astern of the 'group' next to it. This 'group' being altogether out of order, will most likely be afterwards detached for other service. The remainder, having cleared the *melée,* will at once be ordered to reverse their career and will again charge the enemy's line—and so the battle would proceed.

Lastly, let us picture a combat between Fleet I. in 'groups,' and Fleet V. in columns of two or more divisions in line abreast; which might be considered a formation of equal depth and front.

Opposed to such a front, Fleet I. would preserve its original formation (in two divisions of groups in line ahead), only, perhaps, closing the divisions so as to pass through the line of the enemy's front; the first charge will be made by the groups breaking their way through line after line of the enemy, who, as in the last case, will be hampered and prevented from the possibility of making advantageous use of the various weapons with which his ships are armed, by the

proximity of the ships in each line. When once through, Fleet V. would find that complicated manœuvres were required in order to re-form and again meet Fleet I. The groups, following their respective leaders, will be turned as soon as clear of the enemy, and if well managed would be upon them before they are re-formed, inflicting endless destruction and utter confusion on their disordered ranks.

Fleet I. might be opposed to fleets in other formations, such as double quarter lines or even double bow lines. Should it be positively ascertained that the enemy is approaching in one of these formations, a little strategy might be brought into play. Fleet I., by making a strategical movement direct to starboard or port, would oblige the enemy to alter his course, and this is a great object to be gained, as to do so will probably entirely upset the plans of the enemy and cause considerable disorder in his fleet. When sufficiently clear of the former course, Fleet I., in obedience to the two compass signals at the fore and main of the Commander-in-Chief, alters course towards the enemy, and while they are in the act of re-forming on a new course, the rush will be made, with results which should be in favour of Fleet I.

In reviewing these few sketches of tactics in a naval battle, let us just for one moment take the place of the Captain of a ship in Fleet I. If he commands one of the two rear ships of a group, his sole duty, as

regards the manœuvring with his fleet, is to preserve his bearing and distance of the leader of his group, diverging as little as possible from a correct position, and always moving into it as soon as he is able after any necessary divergence; this duty will not be difficult as it is the only thing to be considered, and the leader is at no great distance. If the Captain (or Flag Officer) is in charge of one of the leading ships of a group, his sole duty, in this respect, is to preserve his course, following or preserving his distance on a bearing from the divisional leader or Commander-in-Chief. The first thought of a 'Group' leader, who has brought his group through and clear of the enemy, is to look for the new course and bearing. This signal, he instantly sees and comprehends—say S.E. at the fore; N.W. at the main—a single column in line ahead steering S.E. He has eight cables in which to turn with his group, enough to prevent a liability of fouling another group. He thus leads his command into position without chance of mistake or confusion.

Before leaving this part of the subject I must refer to a very important question on the manœuvring of a fleet in action, namely:—Whether it is advisable that the Commander-in-Chief remains in his flag ship, or quits it to hoist his flag in a smaller and swifter vessel. Captain Colomb, in his *"Lessons from Lissa," approves of the Italian Admiral Persano shifting his

* Journal of the U.S. Institution, April, 1867.

flag, and even advises the general adoption of this plan. In the particular case of Lissa the Admiral by doing so was probably preserved from a watery grave in the *Re d'Italia*; but, with reference to such an event, an Admiral would not only be justified but would be duty-bound to leave his flag ship if disabled or sinking, in order that he might carry on the action from some other ship of the fleet. Captain Colomb compares the management of a fleet with that of an army, and says: *"If a General on land were "restricted as an Admiral is at sea, to the use of signals "for the conveyance of his orders . . . he would "place himself where he could best see and be seen. " . . . I take the same view, that in future "naval actions the Commander-in-Chief will not take "a position in the line." I agree with Captain Colomb so far that it would be very desirable that an Admiral should place himself where he could best see and be seen, but I am strongly of opinion that this place is at the head of his line. On land the General using signals would be on an elevation, looking down on the field before him; he would also have the enemy in a certain direction from him, his own army being immediately under his eye. At sea no detached ship could have either of these advantages. After the first charge or pass of the opposing fleets, how is the detached Commander-in-Chief to order the new

* U.S.I. Journal, vol. xi., page 110.

formation? and on what bearings is it to be made, when possibly the enemy will be between him and his fleet? I hold that in future much more than in the past days of sailing ships—when the wind limited the change of the bearings of the fleet, and when breaking the enemy's line was a most difficult manœuvre—the Admiral should lead in his flag ship. I would not compare him with the Commander-in-Chief of an army, but rather with one of the gallant leaders of cavalry charges. If, by a bold rush, the Admiral passes clear, he is first on the field to form the others as they follow; and, re-formed, to lead them to the attack again.

In speaking of former days, Admiral Jurien de la Gravѐire in his book on *The Last Naval Wars,* written some few years ago and translated by Captain Plunket, gives, in one paragraph, his own and another opinion,—one which should command the assent of all Englishmen:—"But the orders of the government were " positive, that the Admiral should quit his own ship " in action and hoist his flag on one of the frigates. " This detestable arrangement had been adopted in " France, since the capture of the *Comte du Grasse* " in the *Ville de Paris* by Rodney, and the conse- " quence was that two of our bravest officers, Admiral " Martin and Villaret Joyeuse, whose example would " have animated their Captains, were both constrained " about this time to remain passive spectators of the

"misconduct of their officers. At Trafalgar, Nelson "was begged to go on board a frigate that he might "better watch events and transmit his orders, but he "answered that, "Nothing in battle was so important "as example;" and, refusing to let another ship pass "even, he retained the station which his courage had "selected at the head of the column." What man, may be asked, would not follow so glorious an example?

Before passing on from the subject of manœuvring, it is important to ask—What is the value of naval history and the fleet manœuvring of the past to a tactician of the present day? What can be learnt applicable to the tactics of a steam fleet from such deep researches as those from which an admirable article in the *Edinburgh Review* is written? What help can be obtained from Paul Hoste's grand work, first edited in 1697, although translated and enlarged by Captain J. D. Boswell only 39 years ago; or even Clerk of Eldin, who,—like Hoste had done for the French fleet a century before—wrote the first elaborate work on "Tactics for our Sea Forces" in 1804? From these and many other writers such as M. de Morogues or Ramatuelle, what is the lesson we learn?

By an analysis of the article in the **Edinburgh Review*, entitled "The past and future of Naval

* October, 1872.

Tactics," we may fairly test the value of this antique literature. The first object of the writer is apparently to show that in the earliest records of naval warfare, the Persian and Grecian galleys, propelled by oars, were manœuvred with such skill that, for the weapons then in use, this science might be considered to have reached its height. The use of a sharpened bow as a weapon wherewith to stave and sink the enemy's galleys was at that time generally adopted. This mode of ramming appears to have fallen into disuse with the decline of efficiency in manœuvring. The Romans, we are told, possessing little nautical skill—being more soldiers than seamen,—despaired of ever being able to adopt the necessary tactics for using the prow with effect. Grappling the enemy's vessels then became the custom, the Romans considering themselves no doubt, better qualified for a hand-to-hand encounter. From this outline it appears that the use and disuse of the ram depended on the rise or decline of proficiency in professional skill or seamanship. This, I believe, will be more than ever the case in our day. Continuing the narrative, we come in succession to guns used in the bows of galleys, to guns on the beam of ships, and thence to the last two centuries of sailing ships bristling with cannon. During this later period the works before referred to were written. It is supposed by the *Reviewer* that the comparatively small advantages gained by our fleet over the French

during the greater part of last century was principally owing to their study of Naval Tactics, having the works of Paul Hoste, M. de Morogues, and others, and to our blind adherence to regulations laid down by James II a hundred years before, which obliged the fleet to sail in line ahead, taking the weather gauge, and when abreast of the enemy's line 'bearing up' and closing with the whole of the ships together. Rodney, in 1780, was the first to break through this long existing rule, and from that time the method of breaking the enemy's line and doubling on the rear ships appears to have been practised with results so glorious to our fleets. Clerk of Eldin is said to be the originator of this change in tactics; and the writer, in the conclusion of his review, says "that by aid of diagram and letterpress, Paul Hoste taught "the French Navy how to shun defeat, and Clerk of Eldin taught the British how to win great victories." But I again ask, what do we learn from all this that in any way refers to a fight between steam fleets armed with rams? The answer will be found in the following remarks of Admiral de la Gravière on Naval Tactics:*— "When ancient maritime warfare is studied with the "purpose of drawing from it lessons applicable to our "day, it is not information on the subject of Naval "Tactics that we must look for. . . . Whatever the "disposition of the fleet on the scene of conflict, vic-

* "Revue Maritime et Coloniale," July, 1870.

"tory favours the side which is animated with the "greatest spirit, of which the predominating qualities "are, in the Chief Officer, force of character, and in "those under him, confidence and the resolve to "support each other. Therefore it is that the philo-"sophical, rather than the technical part of the history "of conflicts at sea during the last two centuries, must "be studied, in order to throw light upon the questions "with which the present generation is occupied."

The question of the movements and formations of steam fleets is our proper study, and on these subjects, considering their extent, we possess only a very small amount of literature. The French published their signals and instructions in steam tactics in 1857. Sir Howard Douglas wrote some very admirable plans, on which to frame our instructions, in 1858; but the signal book for the British Fleet was in a sadly inefficient state until 1867, when—after a number of experimental evolutions, conducted under Sir William Martin—the present system was adopted and brought into general use. Captain Pellew lectured very explicitly on its principles the same year, having been employed under Sir William Martin in arranging it.

When we consider the vast importance, to a maritime nation like England, of the study of naval tactics, it is a matter of great regret that so few of our fellow countrymen should have devoted their attention to it. It is true that from the writings of these few students

of the science there is much to be learnt, but abroad we find a far more frequent and ample discussion of the many problems of this difficult and important subject.

Among the many foreign writers on Naval Tactics, Admiral Jurien de la Gravière is known for his ability, his clear perception, and his sound judgment. The various works he has published on the subject are of the utmost value to the student.

CHAPTER III.

ON GUNS.

It is only natural that in describing and discussing the various weapons carried by ships of war we should still have the guns upmost in our thoughts. Guns, introduced into Europe in the beginning of the 14th century and first used by our countrymen in 1346 at Cressy, have since that date, year after year, become more important and terrible in their effects; until of late,—owing to the improvement in machinery and the introduction of the principle of building up guns coil over coil—our arsenal has been able to produce pieces of ordnance of very great weight and strength. The largest of these yet sent afloat weighs 35 tons and is capable of throwing a 700 lb. shell three or four miles, the first mile being passed over in about five seconds. This shell if it burst in the centre of such a battery as that of H.M.S. *Hercules*, would probably place half, if not the whole, of the men *hors de combat?*

It is not the object of this essay to describe the manufacture and general use of guns; but to inquire

into the particular value of artillery in a naval engagement, and the system on which it should be worked in order to develop the full gunnery power of the fleet.

I am not, myself, of opinion that artillery is the most important weapon in a fleet. It is, I believe, very generally held by those officers who have studied the armament and manœuvring of fleets that the *ram* is fast supplanting the gun in importance, and that the torpedo,—the construction and use of which are yet quite in their infancy—is a weapon which will effect another revolution in shipbuilding, in fleet manœuvring, and in naval warfare generally.

As regards the armament of vessels I am a strong advocate for the system of each ship carrying at least fifteen guns (and not more than nineteen) of weight and power according to her size and strength. When it is possible (as I believe it will be some day) to enclose this number of guns in turrets, (or even ten guns, eight of which will work on either side) then by all means let us adopt the turret system for ships of the line; until then, the *Devastation* class would be better in reserve for coast defence, being only used in foreign waters when required to enter a fortified port. In performing either of these services the large arc through which their guns can be used would be brought into full effect.

The *Monarch* I consider as a vessel by herself.

I look upon her as peculiarly adapted to play an important part in an action in heavy weather. Suppose England at war, and that news is obtained of the enemy's fleet being at sea off the mouth of the Channel. A gale of wind threatens, and it is known that they must bear up and run for shelter. This is the time for the *Monarch*. Putting to sea in pursuit she could approach the scattered fleet without fear of being rammed in such heavy weather; her turrets well above and clear of the water, admit of the guns she carries being used with perfect facility in any weather, and not only worked with ease but fired with comparative accuracy, the captain of the turret having an all-round view well above the waves, while she would have little to apprehend from the guns of the enemy's broadside ships, which, owing to the narrowness of the ports, can only be fired at hazard and when the object is near the beam (a position the *Monarch* need not hold for any length of time). I maintain that this one ship is capable of inflicting severe punishment on broadside ships caught in a gale of wind, always providing that she is thoroughly well-handled. In this case the elements limit the choice of weapons to the guns, which the *Monarch* alone can use with effect in a heavy seaway. Captain Colomb speaking of the armament of the *Monarch** says, "The *Monarch* has the fewest and heaviest guns of

* R.U.S.I. Journal, vol. xv., page 409.

" any sea-going ship in the navy, and she exercises her " gun power over a larger arc than any other. She is " the embodiment of the idea that the gun is the " decisive weapon at sea, to which all others must give " place, and that this weapon is most powerful when " mounted in limited numbers of the greatest size, " and the largest arc of training." In this I only concur as far as the arc of training is concerned; and this large arc loses nearly all its advantages if the vessel is engaged in company with other ships; under which circumstances I would bind even turret ships of the latest build to the same rules with reference to the use of their guns in a general action as any other ship of the line.

With regard to the question of the advantage gained by mounting a small number of the heaviest guns on board ship, it is evident that the first and most important object in the employment of artillery is to hit the mark; and the second, to hit it as often as possible. For this, accuracy and rapidity of fire are needed. If the number of guns is diminished and their weight increased, the fire naturally becomes slower. Again, we may consider that the value of the artillery fire of a ship will be diminished by at least one-third if she is moving at high speed, and that another third will be lost if the object is also rapidly changing its position. If then, for very heavy guns, we add the difficulty of ensuring in any human being

that amount of unshaken nerve and cool precision which will be indispensable for the effective use of a weapon each discharge of which is of such immeasurable importance, we shall find the value of the system of a few heavy guns reduced to a very narrow limit.

Let us now endeavour to estimate the value of the lighter ordnance. What ship could defy a broadside of 7-in. and 9-in., guns from the *Agincourt*, so well directed that each of the fourteen projectiles strikes home? Suppose this broadside is fired against the *Hercules*. Seven strike impenetrable armour; one enters the battery through a port; three burst on the main deck abaft; one pierces the plating at the water line abaft; and the other two either before the battery or on deck. Would not these effect most serious injuries? It is probable that if all the projectiles were shell, their effect in wounding officers and men, in damaging steering gear, compasses, and perhaps engines, would be quite sufficient to disable the ship for some moments, if not for a longer period; and this supposes seven shell to fall harmless off the thicker plates. I maintain that if, of the large number of shell in a broadside, half can be made to take effect and to penetrate the weaker parts of even our finest sea-going iron-clad, the guns doing this will render most important services. In addition to this the *Agincourt's* battery could fire two broadsides to the *Devastation's* one.

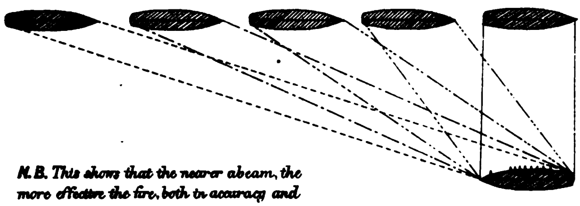
There is a question in ship-building which we must here consider—the steadiness of the gun platform. It is generally believed that a steady platform and a slow movement is desirable in ships of war; but in reality nothing is so detrimental to the correct firing of guns as a slow hanging roll; for, in this case, the rolling motion is sometimes so slow that ships might pass each other when at a high speed without the power of firing a single gun, in consequence of the alignment of the sights when the guns are laid horizontal not being brought on by the roll. The question to be studied in order that a ship may be built with a good platform from which to fight her guns, is, that of placing her weights in the best position for giving her a short, quick roll in a seaway. Comparing the *Minotaur, Sultan,* and *Devastation* in some of their trials, we find that their rolling in the "five minutes' test" was, respectively :— *Minotaur*—38 oscillations, averaging 22·5°; *Sultan*—34 oscillations, averaging 13°; and *Devastation*—46 oscillations, averaging only 9·1° The *Monarch* has a short, but slow, hanging roll, making about 37 oscillations in five minutes. The *Devastation* approaches nearest to what, I consider, is required; but I believe that less top weight would considerably reduce the hanging in the roll of all our iron-clads.

Speaking, generally, of the use of guns in a fleet action, I am much of Captain Colomb's opinion, viz.:

PLATE VI.

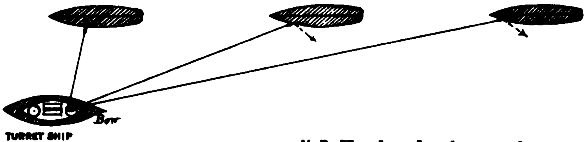
EXPLAINING THE USE OF GUNS.

FIG. I. *Broadside Ships passing.*



N.B. This shows that the nearer abeam, the more effective the fire, both in accuracy and penetration

FIG. 2. *Turret Ship in a General Action.*



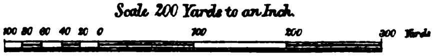
N. B. This shows the advantage of reserving fire, until the Enemy is nearly abeam.

FIG. 3. *Effect of Bow Fire*
A fires first round at 400 Yards

& 2nd round at 30 Yds 1 Min. after

N. B. B can use its Ram, and the firing does not in this case take effect.

Scale 200 Yards to an Inch.



ROBT J COOK & HAMMOND LITH BROADWAY, WEST

that they should be previously laid right abeam and horizontal, and then fired on the instant of passing an enemy's ship. The combined speed of two vessels passing in opposite directions would be so great, that there is no possibility of more than one broadside being delivered, and the old system "Three rounds on the bow, beam, and quarter" may be considered obsolete.

I would lay down six rules for the use of guns in a general action.

1. Guns are on no account to be fired unless there is every probability of their taking effect.

2. The guns on the broadside will always be trained on some pre-arranged bearing, from abeam to 15° before the beam (see Plate VI., Fig. 1.), so that the Captain shall at all times, and without having to give a second thought, be certain of the exact direction in which all his guns are pointing. This instantaneous knowledge is of vital importance when in action.

3. Guns will, as a rule, be fired in broadsides, or by divisions, either from the director on deck, or (if in smooth water) from the sights of one of the guns.

4. A disabled ship with rudder or engines broken down, will use her guns to the utmost of her power, reaping the full benefit of her efficiency in practical gunnery.

5. A ship pairing off with an enemy to "single combat," moving round on the same circle, or finding

herself on the same course as the enemy, will bring her gunnery powers into full play, using *Independent Firing.* The officers will be most careful that there is no mistake in the object to be fired at, its bearing being repeatedly passed down to the gun-deck.

6. As far as possible, the aim is to be directed at the weakest points of the enemy, if they are known. A choice will be barely possible when ships are passing each other in opposite directions.

To the first of these rules I attach the greatest importance in a general action. Opening fire at great and uncertain distances is an error. It would, by distracting the attention of the officer commanding, shaking compasses, and enveloping the ship in smoke, only create confusion and difficulty in managing the ship and preserving a correct course and station, with little or no counter-balancing advantages. Admiral Gravière on this subject says* "As an enemy advances, "an armoured vessel cannot do better than impose "silence on her artillery. The poor advantage to be "gained by a discharge rendered uncertain by the "rapidity with which the distance varies, cannot "compensate for the disadvantages of the cloud of "smoke which would envelope the ship at the all-"important moment when her safety depends on the "precision with which she is handled." I fully endorse this opinion.

* Revue Maritime et Coloniale, July, 1870.

In order to appreciate more clearly the employment of artillery under different circumstances, let us picture a few possible scenes on board ships in action. Suppose two fleets to be approaching each other, both moving at the rate of ten knots. In one, the order having been given to engage whenever the guns will bear, the leading ship opens fire at 2000 yards on any of the enemy at which her guns can be trained. The two or three foremost guns are fired; the captains of the remaining guns strain their eyes through the smoke to see the enemy. Another moment, and they also catch a glimpse of the enemy, and fire. In two-and-a-half minutes from the commencement of the action the order is sent down to the battery, *Enemy passing!* Peering through the smoke, the officers and captains of the guns endeavour to make out the approaching ship. Half the guns are unloaded; all are trained on different bearings; those loaded are fired at random—for with ships passing at such a speed it is necessary to fire at once, or the chance is lost—some are pointed so far aft that friendly ships on and abaft the beam are endangered. Another half-minute and the order is sent down, *Enemy coming down on the bow!* The guns that are not blocked by others pointed on the quarter will train at once, and when round, will, in all probability, find this second enemy already on the beam. When we consider that two ships passing close to each other at the above rate would only be in

a position for firing their whole broadsides with effect during about five seconds, and for firing any of their guns with effect during 18 seconds, the possibility of training the guns at an object so rapidly passing becomes very small indeed. Should each of the enemy's ships as they pass pour in their fire, the confusion in the battery will be greatly increased; and yet the gunnery order of the ship, both in the correct working and laying of guns, may be far from imperfect.

Let us take a look on deck. Here a skilful Captain is guiding his ship, with the steadiest men at the wheel. Fire being opened from the battery rather sooner than is expected, round spin the compass cards. The smoke immediately obscures the view ahead, so that the only chance of preserving the course is to keep the helm amidships. Presently, in order either to avoid being rammed, or possibly to try the effect of his bow on the enemy, the Captain orders the helm to be put to starboard, or port. The ship once off her course, how will she ever regain it? or how, if permitted to turn to any great degree, will she distinguish friend from foe? It will be absolutely necessary to cease firing to let the compasses become steady, and the smoke clear sufficiently to ascertain the ship's position; and all this time she is going ten knots through the water! What will become of her? If the enemy knows how to ram she should be sunk.

Let us now endeavour to picture the scene on board a ship of the other fleet, in which the orders I have prescribed for the use of guns in a general action, have been adopted. She is the leader of a 'Group,' and in accordance with the second rule,* her guns are laid horizontal, on a bearing of 10° before the beam. (The guns of the other two ships of the group would necessarily be laid on different bearings. For instance, those pointing across the group must be as clear as possible of their friends, being probably laid abeam). All the guns are at the *Ready,* and will be fired as a broadside either by electricity or by the captains of the guns. The crews are on the deck amidships, in such a position as to be able to spring up to their guns in a moment. All is quiet and orderly. The enemy approaches, and perhaps opens fire. The order is passed down to the starboard battery, *Enemy passing. Stand by!* All the compasses on deck are locked. During five seconds the enemy is on the correct bearing for all the guns to take effect on some part of her length; and in those five seconds the order is given, *Fire.* The guns are fired with or without effect, as may chance; compasses are loosed; guns are re-loaded; the smoke clears away; and broadside after broadside is fired in a similar manner on the same bearing, as more of the enemy pass. The only cause of confusion would be the projectiles of the enemy, or the

* *See* p. 61.

fouling (ramming or otherwise) of the ship with another.

If the ship has her screw-propeller, rudder, or machinery disabled, she is, as far as speed or steering is concerned, rendered helpless. Under such circumstances, collected nerves to avoid being rammed or to keep station, are no longer requisite: compass cards may spin at pleasure; but how careful and concise should be the Commanding Officer's orders to the battery; how clear and explicit should be the instructions to officers and men of the bearing and distance of the enemy. What judgment must be exercised in order to avoid waste of energy and ammunition, and to use the gun power to the utmost against the formidable and threatening charge of the enemy's ships. Let those in command of gun-division or battery know for certain what is required of them, and then trust to the training of the men for correct and rapid firing. Englishmen should prove equal to the test. One of the most important things in gunnery is a thorough system of circulating orders from the place appointed for the Captain and his staff during an action. Contradictory orders or misunderstood messages would be fatal.

As a last instance, let us suppose that two ships have got clear of the general fight and find themselves opposed to each other in single combat. Each Captain has faith in his guns and gunnery power, and intends

that those weapons shall decide the battle. Such an engagement would probably resolve itself into a repetition of the *Alabama* and *Kearsage* duel. Trying to approach each other, the two ships put their helms over; but being of the same speed and turning power, this only results in their moving round on the opposite sides of the same circle without closing. The Commanding Officer should here again devote the whole of his attention to the guns, with, perhaps, an occcasional glance at the general conflict. Of course one Captain might have greater faith in his ram, and so, by a succession of serpentine manœuvres endeavour to use this weapon. Owing, however, to the irregularity of movement in this case, guns could not be used with the same effect while doing so. When two ships pair off in single combat, intending to fight it out with their guns, Rule 6 will come into force. Officers should direct the captains of the guns to aim at the most vulnerable parts of the enemy—if they are known. A great authority on these matters recommends that plans of the hulls of all foreign iron-clads showing the position of their most vulnerable points should be supplied to our ships, and arranged along the deck. I would suggest, instead, that books containing a number of these plans be ready for issue in case of war, and that then they should be studied and a plan, if necessary, given to each captain of a gun if a single combat is imminent. This would, to a great

extent, prevent such a disastrous waste of labour and ammunition as happened when the *Alabama's* shells, which were expected to explode in the boilers and engines, fell harmless from the protected sides of the *Kearsage.*

On the mode of using guns in action I have said sufficient. I will now indicate how men should be trained in order that the guns may be worked efficiently. Gun drill should be as simple as possible, and the whole instruction should be carried out with the two following points in view. (1) To enable the captain of the gun (and other Nos. who, in the event of casualties occurring, would become captain of the gun) to lay the gun rapidly, and with the certainty of striking an object 100 feet long by 20 feet high at a moderate distance when passing at full speed. (2) To ensure the guns' crews loading and working their guns with the greatest rapidity and accuracy, so that broadside after broadside may be prepared and fired in quick succession. A ship passing at the rate of ten knots down the enemy's fleet in line ahead, of which the ships are two cables apart and steaming at the same speed, will have to fire at intervals of thirty-six seconds in order to pour a broadside into each ship. To do this is only just within the bounds of possibility after the most perfect training; and it could not be done if the guns had to be re-laid when out for a different elevation or bearing.

As I have before stated I place great faith in broadsides as long as a ship is acting in concert with others, and, consequently, has a position to preserve. These broadsides may be fired in various ways—by the captains of the guns, one of whom would direct—by the captain of the guns, by an order from the Director—or by electricity, either from the rear of one of the guns or from the Director.

Electricity, before it can be of service for firing broadsides of guns in an action, must command more confidence and be more certain in its effect than at present. What we require is the introduction of a permanent electric battery, of sufficient power to fire with certainty a number of guns (in series) through slight faults in the wires and connections or any minor damages. This battery should be used freely at all exercises; its services would then be recognised, and its use become customary.

I do not think it would be found convenient to use the instrument termed a 'Director' in action, except in heavy weather when the ports on the fighting deck can only be opened for firing, or in fog or darkness when it is essential that the person directing the broadside should have a good all-round view. Under ordinary circumstances, as it is very important that the person firing a broadside should have the battery under his immediate observation, instead of being dependent on reports through voice tubes, I would advocate the

system of firing broadsides by electricity or otherwise, from the rear of one of the guns in the battery; the officer using the electric-firing-key being within easy hearing of a voice tube from the Captain. Thus the order comes down to the starboard battery, *Enemy passing. Stand by!* the firer looks along the sights and fires when all his guns will take effect, or do the most damage.

During this broadside firing the men should keep clear of the guns. As soon as they are loaded, run out, and laid, all except the No. 1 will 'fall out' amidships and lie down on the deck, not at full length, but in such a position as will enable them to spring up smartly to their work directly the guns are fired. No. 1 will attend to the tube laniards, or the electric wires. No delay will be caused by this plan, and it will conduce to the preservation of order, the regularity of the firing, and the safety of the men.

The case of Independent firing is different; the men could not 'fall out,' as the guns must be worked and fired as quickly as precision will admit. The noise and confusion in a large battery would probably be considerable. It will rest chiefly with the Officer Commanding, assisted by the other officers, to reduce the confusion to a minimum by giving clear and definite orders, so that every captain of a gun may know the approximate bearing of the enemy to be fired at, and have an idea of her distance.

Turret ships would have a great advantage over broadside ships in Independent firing. A turret ship disabled and consequently stopped, should, with her all-round fire and clear view, be still a dangerous foe, if her guns are properly worked, (see Plate VI., Fig. 2). Still, when in the line of battle, I would oblige her to use her guns on the same principle as other ships, firing them together and on a pre-arranged bearing of not more than 15° before the beam. There is another reason for not extreme training the guns. The approaching ship not only does not present so large a target, but that target is at an angle with the direction of the projectile, and therefore offers greater resistance, even if it does not throw the shell off altogether.

Of late, owing to the question of "End-on" attack being brought into prominence by the use of rams, bow fire has been represented by many as all important (see Plate VI., Fig. 3). I believe its value to be greatly over estimated. There are four considerations which detract from its value:—The uncertainty of aim when ships are approaching and closing each other at great speed; the small and inclined target presented by the enemy; the disturbing effect on the compasses and on those guiding the ship; and the concussion and smoke. If the ship was disabled, an all-round fire would be of great value, but even in this case an enemy would attack the beam, if intending to ram, and not the bow. In chase, bow guns are

indispensable, and for this purpose I am in favour of a powerful bow fire, but the guns should be at the same time capable of being fought on the beam; and in ships of line in a fleet action, they should be trained on the same bearing, and fired with the broadside guns. If the ship is disabled, a right-ahead fire will be required, but this appears to me to be the only time when they should be shifted forward in a general action. When it is over I trust that our fleet will require them only for the chase.

A weapon we have heard a great deal of in connection with land warfare is the mitrailleuse. I believe that it will take a place in the next naval engagement. It could, no doubt, be used with terrible effect from the tops of a ship, pouring its fire on to the deck of the enemy, and clearing it of all human beings not under cover.

Before concluding this portion of the subject, it will be necessary to mention one other particular which affects the working of guns. I am inclined to believe that in the next naval battle great loss of life and damage to the ship may occur, owing to the fact that the dangers connected with the supply of powder have not received sufficient attention. A ship is blown up and no one lives to report how the explosion happened. It is concluded that she must have caught fire, and the fire have gradually found its way to the magazine. I think it probable that in future a fire will usually be

of very short duration; either igniting charge after charge towards the magazine and exploding it, (for it should be remembered that we now have to deal with charges of 80-lbs. and 100-lbs. of powder) or perhaps a heavy shell bursting over the magazine hatch, and pouring fire into the very channel by which the cartridges are being passed up. Now it appears to me that this danger would be considerably lessened if the powder were passed out of the handing rooms by means of a machine through which no fire could penetrate, and if the supply of powder was so arranged that—the guns being loaded—there should be another charge for each gun on the deck to be replaced as the broadside is fired—the firing being the signal to pass up powder. It will be seen from this that firing in broadsides will carry with it additional safety in working the powder supply, as between each discharge the magazine could be most securely shut off. With this I finish my detailed description of the use of guns.

CHAPTER IV.

ON RAMS.

THERE can be little doubt of the prominent part that 'Rams' will play in the next naval battle. I will endeavour to write as definitely and concisely on this all-important weapon as my imagination will permit, for experimental knowledge of the subject is so limited that opinion must be principally based on conjecture. Who can say what will be the result of the contact between two of our heaviest rams, moving at a great speed, and meeting either stem to stem, at right angles, or at any other angle? Some will hold one opinion, some another; none can speak from experience. Since the days of Lissa, ships have been built of double the weight of the *Ferdinand Max,* and of double the strength of the *Ré d'Italia.* In that battle (so important as a lesson) the Austrians were no doubt intent making good use of their rams. Admiral Tegethoff, in his report, says:—*" During the general combat " the Commanding Officer of my flag ship . . . " managed to run on board within the space of an

* U.S. Magazine, 1866, part iii, page 74.

" hour three Sardinian iron-clads, of which two sus-
" tained heavy damages and a third was run down and
" sunk." It was with this spirit that the battle was won.

The general opinion of the value of rams may be gathered from the following extracts, all from the United Service Institution Journals. Captain Colomb, in his paper on 'Lessons from Lissa,' says:—*" Let us
" just recall the fact that the serious part of a future
" naval attack does not appear to be the guns, but
" the rams." Again he quotes from a French writer, Admiral Touchard:—†"The 'beak' is now the principal
" weapon in naval combats—the *ultima ratio* of maritime war." Captain Pellew, in his lecture on 'Fleet Manœuvring,' says:—‡" Rams are the arm of
" naval warfare to which I attach the chief importance.
" In my opinion the aim of all manœuvring and pre-
" liminary practice with the guns should be to get a
" fair opportunity for ramming." Captain Dawson admits the great importance of rams, and in his paper on 'Naval Guns,' says:—§" Under many conditions of
" battle, as ships are at present equipped, the stem,
" whether employed to run into high sided, or to run
" over low free-board vessels, would occupy the fore-
" most position."

All these opinions are to the same effect. All

* Vol. xi., page 110. † Page 121 from the same volume.
‡ Vol. xi., page 538. § Vol. xi., page 343.

Naval nations must have rams, and must have men who can guide them. I would go further and say that all ships ought to be rams, and that all officers ought to be practised in manœuvring them.

What will be the probable duty of rams in a fleet action? Captain Colomb, speaking of the effect rams will have in the formation of a fleet for battle, considers that an end-on position will be assumed, in order to frustrate an attack of rams, rather than for the purpose of attacking with rams; this, no doubt, will be often the case. No fleet can ignore the enemy's rams so entirely as to expose its broadside to their attack. The first encounter, therefore, between two fleets equally anxious to engage, will be most likely from an end-on position.

I do not believe it within the limits of possibility for two ships to meet exactly stem to stem. Meeting bow to bow will, I expect, be of frequent occurrence, and such a collision may often be accompanied with injurious effects. The shock between two heavy ships, meeting in opposite directions, would be so terrible that engines might be damaged, if not disabled, and boilers might be displaced, if not specially stayed; though no damage should be done to the ships' bows—each bumping and gliding off the other.

If an enemy is observed to be approaching from ahead, it seems to me that the only chance of frustrating his attack is to keep your bow exactly on to his,

PLATE VII

POSITIONS OF SHIPS RAMMING

Scale 100 Yards to an Inch.

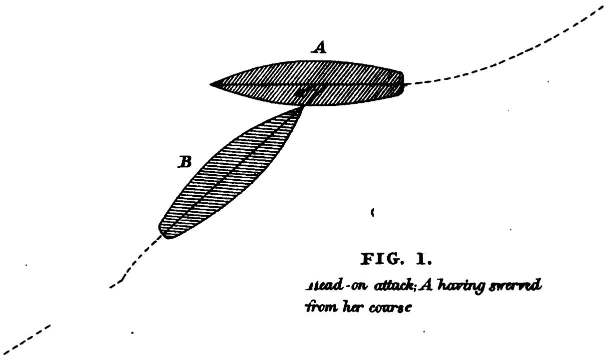
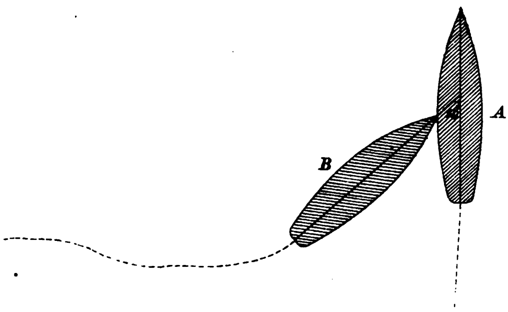


FIG. 1.

Head-on attack; A having swerved from her course

FIG. 2.

Unexpected attack on A from abeam.



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and so meet him. If you swerve, and the enemy is well handled, he will strike you about amidships with his bow, and tear your side open from there, aft, without experiencing any great shock or resistance. Of course the tables might be turned if he gives way or flinches. I endeavour to show this plan of ramming in Plate VII., Fig. 1, as it will be the one most probably attempted by a skilful and confident officer; as also the plan, if properly performed, least calculated to injure the ship ramming. I do not pretend that this will be a simple and easily-performed manœuvre if the enemy does sheer off at the last moment. Even an exceedingly skilful officer might, in the excitement under-estimate the distance, and by giving his ship too much helm, bring her ram in contact with the bluff of the enemy's bow; and so striking where there is the most resistance, he would himself receive a shock, sufficient, possibly to sink his own ship as well as his adversary, who would necessarily be doomed.

When it is possible, therefore, strike your opponent so as to tear her open without coming very forcibly into contact, but still moving along or scraping past her after your bow has once touched. This is very well in theory, but whether it can ever be managed in actual practice remains to be proved. I have thus endeavoured to represent the end-on attempt with rams, and to show the extreme danger of indecision and of swerving at the last moment.

Captain Colomb, in his lecture on the "Attack and Defence of Fleets," speaks at great length on the use of rams; but he treats of their movements when opposed to each other singly more than when those movements are cramped and restrained as they would be in a fleet action, every ship having to preserve an approximate position in station. His admirable paper opens up this subject very thoroughly, and shows an insight into many points which would probably escape ordinary observation. For instance, 'the circle on each side of the bow of a ship proceeding through the water, inside which an opponent is safe from the effects of her ram.' Also, that when two ships are approaching on, and intend to preserve, courses at right angles to each other, it is a matter of a few seconds which of the two will ram the other. In practising the use of rams it is as well to be conversant with these and other facts, though they are at present rather foreign to our subject.

To proceed then, let us suppose that after the first pass or charge of the two fleets engaged, either a reserved squadron of rams charge the enemy at right angles to their course, or, that one side is re-formed in time to make a second attack on its opponents, before they have been able to assume an end-on position. How is this attack with rams to be conducted? My opinion is, that should the enemy be caught off their guard, and attacked by rams on the beam,

the rams should manœuvre so as to strike their opponents amidships, when on a course making an acute angle with that on which the enemy is steering, instead of a right angle. By thus turning slightly towards the enemy's course, the rams would come in contact with less, although sufficient, force; and would, by ranging up into the enemy's course, avoid the ram bows of the next astern, instead of running through the lines and exposing their broadsides to the ships coming up. There is no doubt that an unskilful Captain runs a great risk of losing his ship in a broadside charge, though at the same time he will probably sink an enemy and break their line. The man with iron nerves will be more value than the ship with iron sides, in this mode of fighting. Each Captain, or at least each 'Group' leader, should be a thorough master of the position and equal to the occasion. In Plate VII., Fig. 2, a ship is shown attacking her opponent from abeam, and altering course so as to strike her at an acute angle with her direction. This, I am of opinion is, in theory, the best use of rams attacking from the beam. In Fleet Actions these two plans of attack may be considered the most general. Of course ships may chance to meet at various angles and under various circumstances, but, as I have so often repeated, ships in a fleet are not at liberty to turn which way they please, and a ramming attack, from ahead or abeam, would naturally be only undertaken by a

Commander-in-Chief who has made his intentions, in these respects, known to the Captains of his fleet.

To ram the enemy is not the only point to be studied. What we may deem almost as essential is to be able to do so without endangering your own ship; mutual destruction is by no means an object. What we require, is such admirable management, such thorough ability and foresight in the manager as will ensure the destruction of an enemy exposing himself to attack (if only for a moment) with the least possible risk of damage to the ship which rams. At present our heavy iron-clads are strangers to many of the officers who may be called upon to command them in time of war. In a few years this will not be the case, as all Officers will have probably seen some service in these vessels. The ships of our Steam Fleet, therefore, we cannot expect to be handled in their way so perfectly as those in the fleets of Sir John Jervis and Nelson. In these days very much more actual manœuvring will be required, every movement will be of more importance, and changes will succeed each other with much greater rapidity than in any action fought between sailing ships. Officers well experienced and thoroughly competent to take command of any heavy iron-clad in an action are more than ever required. A great drawback to this will be found in the immense variety there exists in our ships—hardly two being exactly similar. A Captain changing from one ship to

another finds difficulty in learning the different merits and vices of his new command. There is an anecdote told of an officer, who, having command of a steam ship for the first time, hove to when under steam and sail, with his main topsail aback, alongside of the Admiral's flag-ship, without stopping his engines. The ship continuing to go ahead under steam nearly fouled the flagship, when the Officer was heard to exclaim "Oh dear! Oh dear! I forgot I was a steamer." Forgetting very much more trifling things might be fatal to a ship in action in the present day.

In conclusion, it appears to me that ships approaching end-on must stand the chance of bumping bow to bow. This should not cause more damage to a well-built ship than a very unpleasant shake, and the displacement of unsecured articles. If one ship gives way at the last moment, the other should turn towards her so as to strike, if possible, abaft her fore chains at quite a small angle, just sufficient to enter the prow below her armour plating; and, once entered, to force it right along, opening the whole side without its offering any very great resistance. Again, if an opportunity offers of a ship ramming her adversary from abeam, she should, before striking her, turn partly towards her course; first, so as to be more certain of striking her victim; secondly, that she may strike at a great speed without damage to herself; and thirdly, that she may not be athwart the bow

of the next astern, who would be turning to avoid the sinking ship. These two methods should, I think, be practised, and may be said to embrace the whole system of ramming which could be brought into play in a fleet action.

CHAPTER V.

ON TORPEDOES.

WITH a short account of the use of Torpedoes, we will close this part.

These sub-aqueous weapons have never been used in an engagement between fleets; our knowledge of them, therefore, is limited to what has been gained by experiments. I feel inclined to cut this detail short by condemning wholesale, as unfit for use in a fleet action, all but the 'Harvey' Torpedo,—and declaring that a ship could easily be defended against even this; but I fear that explanations of this condemnation are necessary.

In Chap. I., Special Torpedo Steamers are spoken of, and it is proposed that four of these vessels should accompany the fleet. I think the best manner in explaining the use I would make of these steamers, and the mode of working the 'Harvey' Torpedo from them, will be by supposing that we are on board of one during a Naval battle.

Let us imagine ourselves then on board a rakish little craft, fitted for 'Harvey' Torpedo work; we can

steam sixteen knots; we tow a torpedo on each quarter; and we are so admirably fitted with steel protecting mantlets that neither officer or man is exposed either to view or to rifle fire; our instructions are, that on the approach of a hostile force, we and our three consorts are to hold ourselves in readiness to charge the enemy's line, passing through at full speed and doing all the damage that lies in our power. These orders to be carried into effect in obedience to a preconcerted signal. The enemy is observed approaching and apparently moving at about ten knots speed. The torpedo vessels are let loose, and choosing the centre of the enemy's fleet, rush on, steering for a Flagship leading a column in line ahead. Heavy guns are fired at us as we near, but we are so small and so rapid in our movements that no shot take effect; we are reducing our distance at the rate of a mile in $2\frac{1}{2}$ minutes: soon comes the time of suspense; in a second or two we are passing the flag-ship; the port torpedo is dipped—will it strike her? Suddenly a tug on the wire towing-rope and it parts. Her bow has been protected and our torpedo is torn away harmless. However, another mine tows on the opposite quarter, still in working order; we are in the midst of the enemy's fleet, rushing past one after another at half minute intervals; our only chance of using our other torpedo is in breaking through the line; our Commander is eminent for his skill, courage, and confi-

dence; little choice is given us, but he observes a rather greater interval astern of the fourth ship. 'Starboard' is the order, and we break through under her stern; our starboard torpedo is at the same time dipped and passes under the fifth ship. Owing to a combination of luck and good management, the torpedo takes effect and the enemy is blown up. The other torpedo vessels have thrown the enemy into considerable disorder, but none have succeeded in using their torpedoes with effect; one of them has been struck by a heavy shell and totally disabled, but the whole fleet have passed on without finding it possible to capture or sink her without losing their position in station and being left behind; the thought foremost in every Captain's mind, also, being that the enemy's fleet is almost in contact with them, and that the moment to act has arrived.

This is an example of an attack with 'Harvey' torpedoes from ahead, and across the bow. It is, as I will endeavour to show, the only mode of using them that is possible against ships under weigh, and in my opinion it would invariably be rendered fruitless if the bows of the ships attacked were protected by an iron framework of the simplest construction.

Suppose a torpedo vessel passes direct or diagonally from forward across the stern of a ship moving at the rate of ten knots, it is positively impossible for the torpedo to strike unless she is moving twice as

fast. Plate VIII., Figs. 1 and 2, show the extreme conditions of this attack. A, a line-of-battle ship, proceeding ten knots; B, a torpedo vessel going sixteen knots, crossing her stern as close as possible, on a course at 60° from her direction. Fig. 1 shows them when the torpedo-ship's bow is grazing the enemy's stern. The torpedo-vessel is 130-ft. long, and tows the torpedo from forward (30 ft. from her bow) at the end of 300-ft of wire rope, at an angle of 30° from her course. Fig. 2 represents the two ships after ten seconds. A having past over 180 feet and B 290 feet, the torpedo losing ground by being dipped, clears the stern. By attempting this attack the torpedo vessel is also considerably longer under the enemy's fire. If the attack is made from nearly ahead, and with the intention of just clearing the bow obstruction, her opponent, with a slight movement of the helm, will either run the vessel down or bring the torpedo across her bow protection, either of which would frustrate the attack.

The last, and though the most dangerous, yet the least easily attack avoided will be from astern; this would necessitate the torpedo-vessel having a considerable advantage in speed; she would then follow her antagonist, and overtaking her, pass close under her counter, ignoring if possible her fire, and dipping the torpedo under the opposite quarter so as to explode on striking. This would be too hazardous work for any

PLATE VIII.

Attack of a Harvey Torpedo Steamer on a moving Ship, diagonally across the Stern.

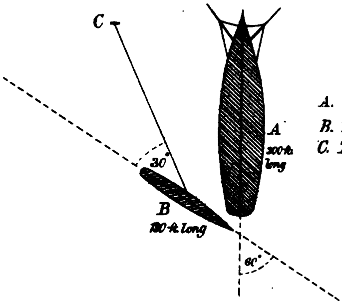


FIG. 1.

A. Vessel attacked at 10 K^ts Speed.
B. Torpedo Vessel of 16 K^ts Speed.
C. The Torpedo.

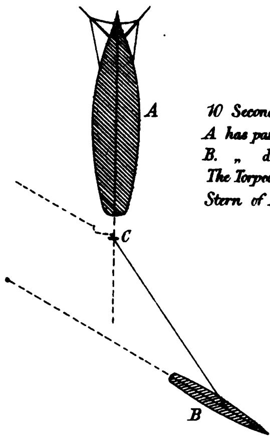
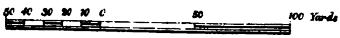


FIG. 2.

10 Seconds after.
A has passed over 180 Feet.
B. " d° " 290 Feet.
The Torpedo tows clear of the Stern of A.

Scale 100 Yards to an Inch.



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but desperate men to attempt, and it could be avoided by the enemy if well handled, and the ship sheared out of range at the right moment or just before the torpedo reaches the stern.

But let us return to our little craft in which we have already run the gauntlet of the hostile fleet. Having cleared the enemy with little or no damage we look back and see our fleet of iron-clads breaking through their lines, which have been so shaken by our assault. When through, our fleet re-forms and wheels for the next charge. We must be at work again—our torpedoes are replaced and everything is in working order. This time we follow our iron-clads to the charge. We are, if anything, more hopeful of success. The enemy will not see us till we are at them, our blood is warming to the work, and we feel that we have gained experience and confidence by the first charge. Steaming on we observe the second charge of the fleet amidst smoke, confusion, and thundering of cannon, the enemy is prepared and it is a case of "Greek meeting Greek." Our vessel is put at full speed and with our consorts (now reduced to two) we go at the enemy. However, in the charge that is made, only one of us succeeds in exploding a torpedo, and that without much damage to the enemy, one of our consorts is run down and sunk, and we pass through only dipping one torpedo and that too late to take effect. The enemy are not in the steady line they

were in before, and consequently we have not such an opportunity of creating disorder, and have more difficulty in manœuvring to use our weapon. Passing on, fortune still favours us. We come across an enemy, disabled, stern on to us, with her ensign flying. "At her," is the order, another moment and we are close to her, our torpedo in beautiful position, and the enemy helpless. Down comes her ensign, just in time; we are able to let go the torpedo so as to clear her,—now a lawful prize.

So it is that I believe a torpedo vessel will be handled in an action. It will be ticklish work, and all I can say is, that the men who undertake it should be gifted with coolness and courage above their fellows, as well as the utmost proficiency in handling their vessels.

Ships-of-the-line will, I have little doubt, tow a 'Harvey' torpedo on each quarter when going into action. These will probably be fitted so as to be fired by electricity from the ship, as the present plan is too dangerous to neighbouring vessels for service in a fleet. I look upon the 'Harvey,' so used, as a defensive weapon, not deeming it possible that any ship—being part of a fleet of ships which have to act together—can for a moment think of manœuvring so as to attack with her torpedoes. I would by no means do away with its use, as, *morally*, its effect would be most valuable, though, *actually*, I believe it

would do little or no damage to the enemy. During an action two or three might be fired, but the chances are, either that they would not be dipped at the right moment, or that they would be fired at the wrong one; or, if fired when 'contact completes the electric circuit,' it will be at the water line, and so, harmless, instead of under the enemy's bottom. A ship passing under your stern may possibly pass over your torpedo, which, if correctly dipped, could be fired with effect; but that ship should have rammed and sunk you (or, at least, ranged up alongside in attempting to do so), instead of being blown up. Again, if a ship is coming at you from ahead, and, in attempting to ram, meets you bow to bow and grazes past your side, I do not think there are many men in this world who would be capable of dipping and firing a torpedo at the right instant in the confusion of the moment. If, on the other hand, your enemy turns from this bow attack at the last moment, he not only exposes himself to your ram, but obliges you to give him your stem or run over his torpedo; there will be but a second or two to decide which you will do. I should advocate ramming.

Torpedoes cannot be towed from the fore part of ships carrying guns, as the towing lines would be blown away when they are fired. Special steamers have the advantage here—there being no reason why they should not carry four, one towing from forward

and one from the quarter on each side. I am, however, inclined to think that one on each side would be quite sufficient for any man to manage with thorough efficiency.

I have referred to another mode of using a torpedo, viz., "that of swinging the torpedo—secured at the end of a pole—under a vessel in passing." When perfected, this plan should be used in combination with the 'Harvey,' both in ships of the line and in special steamers; any bow obstruction that may be used to repel the towing torpedo, would be powerless against this mode of attack.

Having little knowledge of the 'Whitehead' or 'Fish' Torpedo, I am not in a position to give an opinion on it. Its value seems to lie in the impossibility of frustrating its attack, and its defect, in the unlikelihood of its striking the vessel aimed at. I cannot imagine how it could be used in a fleet action; to fire it against the bow of an approaching enemy would be folly; and to fire it when passing at speed would be impossible. Used from boats for the attack of ships at anchor, or from stationary positions for the attack of enemy's ships passing up rivers, or through narrow channels, this weapon will be most deadly and may be used with great accuracy; but at sea, when projected from moving vessels, at moving objects, I do not conceive it possible for it to be used with effect, or with any certainty of striking an enemy instead of a friend.

The Outrigger is also out of the question as a sea-going torpedo.

During the American Civil War, torpedoes were largely employed; but it was principally in river work and against the blockading ships, there being no account of their use between fleets. Torpedo warfare reached such a pitch, that no less than twenty-five vessels were sunk or destroyed by the Confederates. Inventions were no sooner brought to light, than they were employed for actual service. We read of submarine boats, as well as mines of all descriptions, and of these being worked by daring men with terrible effect; we must, therefore, not only be ready to attack with torpedoes, but to repel an attack.

CHAPTER VI.

CONCLUSIONS.

In this part it is my intention to examine briefly the subjects discussed in Chap. II., and from them to state as concisely as possible the conclusions that I have come to.

Preparation of the Fleet.

When once war is declared with a Naval nation, there will no doubt be a tremendous push to get our ships ready and turned out of hand with all speed. A politic government will foresee when affairs are coming to such a climax as to cause war to be imminent, and will no doubt have the fleet prepared for service accordingly.

A vast amount may be done towards getting the fleet into order without a shadow of suspicion being raised of any preparations being made. Ships already in commission could be docked and have the fouling cleaned off them; officers on half pay could be confidentially warned to hold themselves in readiness to join certain ships at a moment's notice; stores could be

arranged ready for supply immediately on the question of war being decided; and the whole plan of the work to be done in all Dockyards, Victualling Yards, and Arsenals could be weighed, considered, and then definitely decided upon, ready for any emergency.

War, then, being declared, I presume that all ships already commissioned will be sent straight off to the rendezvous out of the way of the dockyards. Any additional stores, extra ammunition, new torpedo gear, or plans for protection, will be sent to the ships in hired steamers from the different stores. This will enable the dockyards to put all their energies into the work of getting new ships fitted out and ready. It must be remembered that these ships should not only be prepared to take the sea, but also to join the fleet; the men being in some sort of working order, and the officers having had some practice in handling their ship, her capabilities having been fairly tested.

There is one thing which I consider indispensable in all ships of a fleet in war time,—a bow protection against the 'Harvey' torpedo. Whether it is formed of spars well martingaled, or iron framework, is of little consequence. A ship is very seriously risking her existence if she cannot frustrate a bow attack of a 'Harvey' torpedo steamer.

Organization of the Fleet.

It is manifestly of the utmost importance that the

Commander-in-Chief of the principal fleet should be named, appointed, and hoist his flag at the rendezvous at the earliest stage of the process of equipping and preparing a fleet for war service. He will then, as the ships arrive, commence the organization or telling off of the fleet.

From what has been said in Chap. II., my opinion of the manner in which a fleet should be divided is very apparent. I would strongly recommend that the system of arranging the ships *into groups of three,* and the groups into two as well as three or four divisions. I firmly believe this to be the simplest, the most convenient and efficacious mode of dividing the fleet, or rather telling off or organizing the fleet.

Every opportunity would doubtless be taken by the Commander-in-Chief to explain to the Captains of his fleet the principles on which he intends to carry out its organization and manœuvring; and from the earliest period of his taking command he will give those Officers every facility for understanding his ideas on these points. In aid of this principle, there is no reason why, during the organization, the ships already at the rendezvous should not be taken out to sea for exercise in the manœuvres and tactics it is the Admiral's intention to make use of. Not that these ships—which have possibly been sometime in commission—would be deficient in the ability to

manœuvre correctly; but that their officers may become sooner acquainted with the views of their Commander-in-Chief and with his mode of conducting the fleet.

PRACTICE IN MANŒUVRING.

Preliminary exercises in Steam Tactics may be practised whilst the ships are assembling, but the grand manœuvres cannot be fully carried out until the fleet is complete; and then it will be sent to sea, possibly on its way to assail an enemy, but in any case a thorough course of instruction should be gone through.

On the extent of the preparation that individual ships have undergone to fit them for exercise with a fleet, on the simplicity of the system of manœuvring to be adopted, and on the manner in which the instruction in this system is carried out, will depend the state of the fleet when it is required to engage the enemy, which will, perhaps, be only a few weeks after war is declared. An Admiral who, whilst enforcing the exact execution of his orders, uses sufficient judgment to prevent the exercise becoming irksome and tiring to the officers and men, would very soon get a fleet into good discipline and working order. It is by unnecessarily prolonging the hours of exercise, and by too often repeating evolutions of minor importance, that the officers become wearied and careless of the results.

In a well-organized and disciplined fleet it should not only be natural for the ships to be at all times in correct position, but also that the officers during evolutions should almost instinctively comprehend what is required of them. Admiral Jürien de la Gravière describes the meaning I am anxious to convey. He writes :—*" Il faut surtout posseder la science " indispensable, celle qui consiste a comprendre le chef " à demi-mot, à surveiller les deviations de la route, " à s'inspirer de son exemple et à se passer de ses " signaux. Tout le secret de la Tactique navale est " là." Thus it will be for the 'Group' leaders to divine the intention of, and to work with their Commander-in-Chief; and thus also will the junior Captains be required to understand and conform to the movements of their 'Group' leaders.

The 'Group' system explained in Chap. II., if introduced, would greatly simplify and reduce the number of the evolutions required in preparing a fleet for war service. In it are described the five internal formations in which groups can be moved, and the few fleet formations that are required to bring a fleet to a state of efficiency.

It is claimed for the system of 'Evolutions in Groups' that as the fleet formations are few, and those few so simple, much more time may be devoted to practising the changes of course and ensuring the

* 'La Marine d'Anjourd'hui,' page 208.

mobility of the fleet. There is nothing so important as this; and I believe that the 'Group' system will be found to admit of the fleet having greater mobility than any other.

Admiral Jurien de la Gravière, speaking of a Captain's duty, writes:—*"Il faut apprendre a faire "mouvoir dans un espace restreint des masses de "6000 ou 7000 tonneaux, qui ne peuvent venir en "contact sans le broyer mutuellement." This power is only to be gained by experience. Continued practice in changes of the course of the fleet, turning the 'Groups' together (or in succession) any given number of points, and obliging each ship to keep station from her leader as nearly as possible, would be the exercise required to gain this end.

The 'Formations' and 'Changes of formation' are usually made without altering the course of the fleet. I have endeavoured to explain in Chap. II., how these square movements would best be performed, so that the speed of the vessels in the group need not be altered, the two rear ships turning together a short time after their leader.

In these days *time* is the great object. The time that can be spared for assembling, organizing, and preparing a fleet to meet an enemy may be very limited, and the speed with which all this can be performed may be of the most vital importance. The component

* 'La Marine d'Anjourd'hui,' page 207.

parts of an army can at all times be, to certain extent, prepared to take the field, but this is not the case with a fleet. Many new ships have to be commissioned—strange officers and crews have to be employed; so that although the actual moving of a sea force may be more rapid than that of an army, its full preparation for service will require more time.

If, then, time is very much limited, the principal practice in manœuvring must be performed when the fleet has put to sea in search of the enemy. Unfavourable weather, and various causes, may prevent there being time for much practice, in which case the necessity of having definite instructions, comprehensive regulations, and the simplest of manœuvres, will be apparent.

Examples of General Instructions for Battle.

Example 1.—By the signal, "*Prepare for Action,*" it will be understood that ships are to follow out all the instructions that may be laid down from time to time for clearing away and sending down spars; clearing guns and decks for battle, and rigging-out protections, &c.; also that all fires will be lighted and full power of steam prepared with all dispatch.

Example 2.—On sighting the enemy's fleet, course will be altered by signal towards it, and then the formation, in which it is intended to attack the enemy, will be made.

Example 3.—The fleet having undergone a moderate amount of exercise in manœuvring, a conference will be held on board the Flag-ship, for the purpose of drawing up the plans of action under various circumstances; these plans once arranged and numbered, will be fully explained to the Captains of the Fleet. When the fleet has been prepared for battle and arranged in the formation for the attack, the number of the plan (referred to) that it was decided to act on will be signalled. After this action, signals (on the principle described in Chap. II.,) alone will be used, until annulled when the battle is over.

Example 4.—In the formation for the attack, groups will be arranged in whatever 'group-formation' may be considered necessary; but after the signal to engage has once been made, the Divisional and 'Group' leaders must use their discretion in keeping their rear ships under protection, by altering the formation when circumstances require it. (These formations are described in Chap. II.)

Example 5.—Throughout the engagement 'Group' leaders will do their utmost to preserve their bearing and distance from the Commander-in-Chief, or division leader. The distance between 'Group' leaders will invariably be eight cables; the bearing will be signalled from time to time. The rear ships of each group will preserve their station correctly, and will look to their leader for any alteration in the internal

formation of the 'Group;' as well as carefully conforming to all their leader's changes of course and movements.

Example 6.—In passing through, or by the enemy's fleet, a straight course will be preserved as nearly as possible; ships are not to diverge from this to any great extent, for the purpose of using or avoiding a ram; and, after a divergence, are to get into station again with all speed. Directly the 'Groups' are clear of the enemy, they will be re-formed in nearly an opposite direction; the course and bearing being ordered by signal.

Instructions, such as these, will be found most essential; and if the time for practice in manœuvring is short they will be indispensable.

EXAMPLES OF REGULATIONS FOR THE USE OF GUNS, RAMS, AND TORPEDOES IN ACTION.

These are some of the conclusions I draw from the arguments in Chapter II. To be thoroughly understood in this Essay it will be as well to refer to this part. With a fleet, such instructions as these would explain themselves as the officers became conversant with the intentions of the Commander-in-Chief, and his mode of procedure in conducting the fleet.

Example 1.—*The use of guns in action will be considered under three different conditions:—*

1. At the commencement of an action and during the time that a ship is working as the component part of a fleet, with full command of propelling and steering power, when guns will be fired in broadsides at the enemy passing—having been laid horizontal (if smooth water) and trained on a pre-arranged bearing, which will not exceed 15° before or abaft the beam. Bow and stern guns will be fired on the same bearing, if possible, and at the same time as the broadside.

2. If a ship pairs off with one of the enemy, or finds herself on the same course as an enemy, guns may be trained off the pre-arranged bearing, and independent firing may be ordered,—if considered advisable.

3. A ship disabled will use her guns to the utmost of her power; preventing, if possible, the approach of an enemy's ship, by maintaining a destructive fire in any required direction (see Chap. II). It must be remembered that the part of the ship best calculated to resist an attack of guns and to throw off the projectile, is the bow.

Example 2.—*With respect to the use of rams:*—

1.—When ships are moving in fleet order, they will not diverge to any great extent from their course, in order to ram an enemy.

2.—When an enemy approaching from ahead turns her bow direct towards yours, she will probably strike and sink you, unless you turn direct towards her, or

have time and space to turn off in quite a different direction. In the former case, if the two ships are determined not to flinch, they will meet and strike bow to bow; if on the other hand the enemy swerves at the last moment, the utmost judgment must be used; and by the least movement of the helm you should turn towards the enemy and strike her amidships, at an angle of about 40° with her course.

3.—A ship charging another from abeam should, if possible, range partly up into her course and steer so as to strike her at about an angle of 50° with it, and so forcing her bow well into her opponent she will drop astern on the same course.

4.—The engines should be stopped before actual contact, but it will be advisable to continue at full speed until contact is certain, as by reduction of speed or stopping, command of the turning power is lost to a considerable degree, and by turning the engines astern it is totally lost. The blow to your bow should be decreased in the attack from ahead, by striking where there is comparatively little resistance, and so passing on; and in attack from abeam by turning slightly into the same course, and so making the speed of contact equal to the difference between the speeds of the two ships in the direction on which the vessel attacked is proceeding. These, theoretically, are the modes of attack with rams; (on the use of rams see Chap. II.).

'Harvey's' torpedoes will be towed from each quarter of all ships of the line and will be fitted so that they can be fired by electricity from the ship. On passing close to an enemy no opportunity is to be lost of using this weapon: but ships are not to manœuvre and so lose station for the purpose of attempting a torpedo attack. The bow protection against towing torpedoes is always to be rigged when preparing for action, and should be replaced if knocked away as soon as it is practicable.

Special Regulations for other Vessels attached to the Fleet.

The detached squadron of cruizers will comply with their instructions in the duty that is required of them: in looking out for and reporting the whereabouts and strength of the enemy; in obtaining information from every available resource, etc., etc. During an engagement between the two iron-clad fleets, this squadron will assemble under the direction of their Admiral, and keeping well clear of the ships of the line, will watch proceedings and be ready to assist damaged ships, cut off torpedo steamers, and harass the enemy's smaller vessels as much as possible without coming in contact with their iron-clads.

Special torpedo vessels will be ready to make the first attack on an approaching enemy, at sixteen knot speed, if so ordered, in which case they will do their

utmost to create confusion in their fleet by passing through it, and if possible, making use of their torpedoes on the way. After the first attack they will watch their opportunity and cause further disaster to the enemy when it lies in their power.

Should the fleet be attacked by vessels of this description, the ships being all protected forward, will on no account diverge from their course, except under the following circumstance:—If the torpedo vessel approaches on either bow in a direction making the angle with the course of from 30° to 60°, the ship so threatened will turn sufficiently from her opponent to catch the torpedo on the bow obstructions. This attack alone could not be successful on a moving ship fitted with bow protection.

Examples of the Plans of an Engagement.

All the time that can be spared having been employed in continual instruction in Steam Tactics and Manœuvring, the Commander-in-Chief will cause the plans of action he intends to carry out to be arranged and circulated in his fleet. There is little doubt that a conference with the flag officers and captains under his orders—who will now be well versed in his opinions and manner of conducting the fleet—would be of the greatest assistance to the Admiral in forming these plans, for his duty is not only to command and direct, but also to gain the confidence and respect

of those who serve under him by the judicious exercise of his authority. We will say then that a conference having been held, at which suggestions and opinions were submitted and considered, plans of an engagement are determined upon which will suit different circumstances, and that they are circulated in the fleet. I will attempt a few samples of them.

(Example). Plan I. will probably be used when there is plenty of sea-room, and if the enemy (when sighted) is observed to present a narrow front—being most likely in 'two divisions in line ahead,' the columns close together. Direction will be altered, and the fleet will be formed into 'columns of two divisions in groups in line ahead' (if not already in this formation), then the number of this plan will be made. The groups will be formed in the 'Internal Formation 2,' (the second ship on port quarter of leader, etc., see Chap. II.). On nearing the enemy's fleet, course may be slightly altered, in order to cause it to pass outside the starboard or first division, the group leaders of which division will call their rearmost ships under cover by the signal for 'Formation 4,'; and so the Commander-in-Chief will lead the first division along the enemy's line, opening fire in succession as the broadsides will bear. Just as the leading ships of each fleet meet, the port, or second division will be turned together eight points to star-

board by signal, and steering so as to pass astern of the first division, will charge the enemy along its whole line as it passes clear of the first attack. The utmost discretion must be used in carrying out these instructions. As soon as the enemy is cleared, the starboard division will turn in succession about sixteen points to port. The port division will turn first eight points to port together, and then sixteen points to port in succession; and will form on or astern of starboard division, as per signal. Thus, the fleet being re-formed, it will be led to a similar attack a second time, all instructions being carefully attended to.

(Example.)—Plan II will be used when there is plenty of sea-room and the enemy is observed to present an extended front. The fleet will then be formed in groups in line abreast, and the number of the plan having been signalled, it will charge the enemy and make the best use of guns or rams in breaking through their line. Directly the groups are through they will turn together, about 16 points to starboard, and be again led against the enemy. Should the line of groups overlap, those groups which find that they will clear the enemy's line by proceeding on their course, will turn towards its flank ships, in order to charge them from abeam; but they must reverse their course as soon as possible, so as to be clear of the fleet's return when re-formed. And so the action will be renewed.

(Example.)—Plan III. will be used when there is plenty of sea-room; and when the enemy is observed to present a complicated formation, being apparently in division in double quarter-lines.

The fleet will then be formed into two divisions, of 'Groups' in line ahead, the divisions half-distance apart; and the number of the plan will be signalled. The fleet, in obedience to action signals, will be prepared to make a flank movement, either to port or starboard, and so take up another position from which to attack the enemy; turning by signal to re-form, and then charge their fleet in two divisions as above.

Other plans would be required in the vicinity of a coast line, or shoal water, as also if there was a convoy to attack or defend, and under various circumstances.

These plans might be much more complicated and elaborate, if the fleet is thoroughly drilled and able to manœuvre in the presence of the enemy. Strategical movements, such as moving to a flank at the last moment, so that the enemy would have to receive an attack from an unexpected quarter, would be of admirable service in gaining an advantageous position of attack; but, it must be borne in mind, that the fleet trying these manœuvres must be equal to the occasion, and be properly formed in good order before coming in contact with the enemy, otherwise it will be caught at a disadvantage.

To conclude; the principles I advocate, are:—

1st. That the 'Group' system is the best on which to organize a fleet, and take it into action.

2nd. That Rams should be freely made use of.

3rd. That Guns should be fought nearly on the beam and fired in broadsides.

4th. That Torpedoes should be used by special steamers; and that our ships should invariably be fitted with protections forward, against an attack from them.

II.

Essay on Naval Tactics:

BY

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"*Mobilitate viget, viresque acquirit eundo.*"

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CHAPTER I.

HISTORICAL RETROSPECT.

THE scientific study of Naval Tactics is so new, and in our service at least, has been so little followed, that, entering on it, we find ourselves on almost untrodden ground, without guide, without precedent; for, though many questions arising from it have been practically worked out by the masters of the art in by-gone ages, leaving us valuable lessons on many points of detail, it is only as such that they can now be considered. From a general point of view, the subject has been systematically neglected and discouraged, and the few who have attempted to investigate its rules have been looked on as wild theorists, rather than as workers in an exceptional branch of science which must necessarily lead to practical results of inestimable value. Opinion in respect to this is now happily changing; it is no longer held to be unprofessional, unseamanlike, un-English, to know anything about the conduct of a fleet, or to have ideas extending beyond holystones or scrubbed hammocks. Our officers read more and think more than formerly, and, in their study of the history of the

past century, become alive to a knowledge of the fact, which we have been too apt to ignore, that the wonderful victories which our fathers achieved during the wars of the French Revolution were of a distinct class from the naval battles which preceded them; that although, after the inauguration of that series by Lord Howe, on the 1st June, 1794, it became a practical rule that the meeting of an English fleet with one of the enemy resulted in the total destruction of the latter—a rule followed to its extreme and most glorious consequences by Lord Nelson at the Nile and at Trafalgar,—such a rule was altogether a novelty in the service; and that, for at least fifty years before, the rule of action had been rather to fight indecisive battles, with little result so far as the fleets were concerned, whatever effect they might have on the strategy of the campaign, or on the general result of the war.

Not that our Navy did not, during the last century, win many glorious victories; as for instance, on the 20th November, 1759, when Sir Edward Hawke destroyed the French fleet, under Conflans, in Quiberon Bay, where the enemy, driven into a corner by stress of weather and the attack of our fleet, were unable to practise the tactics of withdrawal which so often rendered them good service; or again, on the 12th April, 1782, when Sir George Rodney utterly crushed the French fleet, under La Grasse, off

Dominica, where—not to plunge into a sea of angry controversy—the English, by passing through the enemy's line, were able to compel them to continued and decisive action.

Nor, on the other hand, did we sustain any severe defeats, so far as our force on the field of battle was concerned; but we did sustain defeats which, serious in their effect on the result of the campaign, were still more serious in their effect on our Navy, because, being misinterpreted by tactical ignorancc, and misunderstood, they were not reckoned as defeats, and were even boasted of, and may still be found boasted of, as victories.

In illustration of this, it is as well to name distinctly some of the more noted of those battles at sea, during the last century, which have most commonly been spoken of as "drawn."

Of these, the earliest in point of time, the most fatal in its effects, was Matthews's action off Toulon, in 1744. I believe that, in this battle, Matthews was perfectly right, not, perhaps, in what he did, but in what he wanted to do. So far as we can see, his idea was to follow the example set him by Sir George Byng, in 1718, when he destroyed the Spanish fleet on the east coast of Sicily. On that occasion, the Spaniards were withdrawing in a more or less correct line of battle; had Byng endeavoured to attack this fleet, which was clearly avoiding him, in line, in the

manner prescribed by the Fighting Instructions, there could not have been any fight at all; the Spaniards must have escaped, and would have won, politically speaking, a victory. By giving a liberal interpretation to the Instructions, he assumed that the fleet withdrawing, was, in the language of those Instructions, "put to the Run;" he applied, therefore, the Instruction for Chase, and attacking as he did, each ship closely engaging the first of the enemy with which she came up, others following ready to assist if necessary, or to push on in search of a new foe, the Spanish fleet was captured or destroyed. That the victory was so overwhelming must, of course, be attributed to the individual superiority of our ships, which were able, for the most part, singly to capture the ship opposed to them; but, even if this had not been so, the result must have been essentially the same; for, as a necessary consequence of the tactics of the battle, it was open to the English to lay two or three or even more ships against any one whose resistance called for greater force.

Matthews, finding the allies off Toulon inclined to avoid close action, endeavoured to force them to it by a somewhat similar proceeding. Had he been able to carry out his conception, the action must have become general, and, one way or other, decisive. His real and very grave fault, as a Commander-in-Chief, lay in his inability to persuade or compel his sub-

ordinates to assist him, or to understand and provide for their unwillingness. The personal differences which existed between him and Lestock, prevented the latter from heartily co-operating with him; and the Fighting Instructions, literally interpreted, afforded a legal excuse for his not doing so. But it is impossible to reflect on this action, and on the judgements pronounced by the Court Martial that followed, without being persuaded that they fettered us, for years, to the most wretched system of tactics that was ever devised; which grossly misrepresented the genius and intention of Penn, the first framer of the Instructions; and which was utterly incompetent either to bring about a general action with an unwilling foe, or to lead to any satisfactory advantage over one equally ready to fight; and which led to the indecisive actions which were really strategic defeats, and the consequent Courts Martial which occupy such a prominent place in our naval records of the last century: such as, in an especial degree, Byng's action off Minorca, involving the loss of that island; Keppel's action off Ushant; Byron's action with d'Estaing, off Grenada; not to mention also the several other unsatisfactory actions fought in the West Indies and on the coast of America during the same and following years.

Byng's action was virtually a defeat, and the loss of Minorca was the immediate consequence of it. Keppel's action was also a failure; the enemy, in

good order, held their ground, and slowly retired without loss, without molestation. Byron's action was still more distinctly a defeat; the English fleet withdrew, the French were confirmed in their recent conquest of Grenada, and for some months were masters of the West Indian seas. The Courts Martial on Byng and Keppel, the tragic end of the former, the angry feeling attendant on the latter, have given to their respective actions a notoriety, both in and out of the service, to which they would otherwise have had no claim: in principle, they were in no way essentially different from the others to which I have referred; in the language of naturalists, they belonged to the same family; they were all fought according to the principles and tactics prescribed by Matthews' Court Martial, or rather by the interpretation it had put on the Fighting Instructions—principles radically faulty, and which could not lead to any other result.

It may, of course, be maintained, and has commonly been maintained, that the blame of the faulty tactics, on which these actions were fought, rests on the Fighting Instructions, rather than on the Court Martial which fixed them a lasting incubus on the service. It is worth while to notice that the Instructions were first drawn out for the guidance of our fleets against the Dutch—enemies who at all times proved themselves as ready to fight as our own countrymen; and that in the mind of Penn, whose

experience was gained solely in the Dutch wars, there could be little or no idea of the less dashing tactics which the French afterwards adopted. Sir George Byng would seem to have ably appreciated the difference between the circumstances in which he and the author of the Instructions were placed, and to have somewhat forced their meaning in consequence. It was left for the tribunal I have named, overlooking this difference, to confirm these Instructions of a past age in their strict and verbal interpretation, and by the rigour of their sentence, not only to discourage, but to prevent anything like independent judgement. Accordingly, the cautious tactics of the enemy rendered us comparatively powerless. To the French resolve to avoid a decisive action, unless with some overwhelming advantage, the English could only oppose an anxious desire to fight; this they were restricted from doing except in the prescribed manner—bringing the whole fleet in line simultaneously against that of the enemy. Such an attack led, in all cases, to a passing or partial interchange of fire; and the French, running down to leeward, formed again in good order, leaving the English line to wear in succession, and to stand towards them again when the line was reformed. This was never achieved: the damage the ships sustained in their masts and rigging, as they passed to windward, and the imperfection of the signals, combined to render the task practically impossible,

and to give rise to the Courts Martial which disfigure our naval annals.

I have alluded to the ignorance that our fleets were defeated as one of the worst features in the prevailing want of tactical knowledge. The French were spoken of as running away; as afraid to fight; a thousand disparaging epithets were invented for their Navy and their officers; but it was not perceived that in each of these actions we had been out-manœuvred; that the French refusal of battle was based on strategic considerations; and that each indecisive encounter, under the circumstances, was for them a strategic victory.

The fact is, that the French of that century studied tactics with a view to making them subservient to their strategy, whereas, the only tactics allowed to our fleets was to form line of battle to windward, and in that formation to engage; a formation and mode of engagement, which was in no case successful, and led to disappointment after disappointment. When circumstances enabled the French to adopt a bolder strategy, we found their tactics of attack as superior as their tactics of defence; and, De Suffren, in the East Indies, was the first in modern naval war who clearly acted on the principle of concentrating his forces on one point, instead of dispersing them along the whole line. That this principle lays down the one and only sound method of attack, whether with fleets

at sea, or with armies on shore, may be stated as a tactical axiom; but, it is impossible now to say whether it had been recognized by the French before De Suffren endeavoured to give it effect. De Suffren was a man of great experience, as well as of great ability and force of character. As a midshipman, he was present in Byng's action; as a lieutenant, he was made prisoner when Boscawen annihilated De la Clue's squadron in the Straits of Gibraltar; and as a captain, he commanded the leading ship of the French line, under D'Estaing, in the engagement with Byron. He had seen the miserable results of the English mode of attack in line, and had experienced the effects of their tactics of chase as applied by Boscawen. When he came to have an independent command, and policy rendered a bold strategy absolutely necessary, he at once adopted—we may almost say inaugurated—a method of attack which, in the war of the French Revolution, enabled our fleets to win such overwhelming victories, and which, perhaps, stands out more clearly defined in the battle of the Nile than in any other.

I would not, for one moment, be supposed to say, as the French have said, that De Suffren, in the East Indies, won great and glorious victories. Though his campaign was on the whole successful, the battles were all indecisive; but this may fairly be attributed to the marked inferiority of his ships' companies, and

the mutinous or cowardly character of his officers; and there can be little doubt that, had the captains of his ships been men of the same noble courage as King or Alms, or had his ships been manned as the *Exeter* or *Monmouth* were manned, the result of the battles of the 17th February, or of the 12th April, 1782, must have been very different. Against such an enemy, Sir Edward Hughes, a brave old sailor, utterly destitute of genius or tactical knowledge, could bring merely the unflinching bravery of his officers and men. Under the circumstances, these were sufficient, and yet only just sufficient to save him from the fatal effects of his ignorance and of the tactical superiority to which he was opposed.

As remarkable instances of tenacious courage and fierce determination maintaining itself against a force which was tactically and theoretically overpowering, the East Indian battles of 1782 and 1783 are worthy of careful study; the more so, as they call attention to the extreme alteration in the circumstances under which we would now engage. We see the *Exeter*, on the 17th February, or the *Monmouth*, on the 12th April, holding their own against a threefold force of the enemy, and enduring to the end the heaviest fire which could be brought against them. Now-a-days, such a state of things is simply impossible. If a ship got into such a position as to receive, at very close quarters, the attack of three ships of the line, or rather

of their modern equivalents, she could not float for five minutes; whether by the ram, or the heavy, concentrated fire, she must be sunk immediately; her officers and crew might be of the most undaunted bravery and devotion, but these noble qualities would be put under water before there was time to exercise them.

Our experience of the effect of shell against ships is small, but it is sufficient to convince us that, if a large shell were to burst in the battery, the crew of that battery would be neither able nor willing to stand to their guns. It is ridiculous to talk, as is often done, of the steadfastness of Englishmen. Without any wish to depreciate the stern pluck of our countrymen, proved in many a hard fought battle, the absurd exaltation of it is dangerous; and our men, the same as men of any other nation, will fly from bursting shell. I believe that a 700 or even a 300 pound shell, exploding in a ship's battery, would render that ship practically "hors de combat." Of the effect on a ship's side, iron or wood, we may speak more confidently; and a very slight reference to the records of target experiments shows that such a shell bursting in or near the water-line, would dangerously alter the ship's trim, even if it did not immediately send her to the bottom.

This very radical difference in the conditions of naval war now, and of naval war at the beginning of the century, points out, more almost than anything

else, the absolute necessity for naval officers to have such a knowledge of tactics as may preserve them from letting their ships be put into a position of certain destruction. The extreme difference in our present ships, in steam, in armour, in guns, in power of ramming, in the use of torpedoes, necessarily involves an extreme difference in the manner in which tactical problems have to be solved; but the differences all join to enforce, with many times multiplied meaning, the one great tactical principle of overpowering concentration on a selected point, as the essential condition of successful attack or defence.

But even in the application of this principle, and in the study of naval tactics, there is one great danger to which perhaps we, as Englishmen, are especially exposed. Our victories, during the war of the French Revolution, were so overwhelming—victories gained, too, with forces often numerically inferior—that we are apt most naturally to consider that they are to be attributed principally, if not entirely, to the tactics which our admirals adopted; and that these tactics ought, therefore, to guide us in the future, and to form the basis of all our deliberations. It is difficult to clear ourselves from the dazzling fascination which surrounds the memory of these glories of the past; but when we do so, we have to acknowledge that, whilst the decisive nature of the enemy's defeats was undoubtedly due to the tactics adopted, these tactics

were nevertheless suitable only for particular occasions, and could be successful only under very remarkable circumstances. It is a matter of familiar history that the French Navy, which, from the time of its re-organisation, by Colbert, in the latter part of the 17th century, continued during the whole of the 18th as a highly aristocratic corps, was rendered almost destitute of officers by the very first effects of the Revolution. The place of those who escaped, or who were butchered, was filled up with incapable ruffians, who may, in some instances, have known something of the duty of a "landsman," but who rarely indeed knew anything about the conduct of either a ship or a squadron. When the whole service was turned upside down, discipline and seamanlike skill rapidly disappeared; and the blockade which our fleets were able to keep up effectually prevented their being regained. The fleets of 1780, '81, and '82 possessed officers, seamen, and gunners; gunnery practice, on both sides, was certainly very different from what it is now; but none the less, familiarity with the great gun gave a certain rude skill in its use; and that attained by the French gunners, before the Revolution, was by no means despicable. Thus, in Byng's action, 1756, several of the ships bearing down on the French line received such damage in their rigging as to be unable to engage or to renew the engagement; as notable amongst these may be named the *Intrepid*, whose disaster was made,

to a great extent, the nominal excuse for the miserable result of the battle; but the ships of our van, which alone were closely engaged, sustained such damage that they were unable to close up to renew the fight, and even next morning were still crippled. So also in Byron's action, 1779, in which desultory as it was, several of our ships—the *Lion*, *Monmouth*, and *Grafton*, in especial—were reduced to helpless wrecks, able only to drift to leeward.

Had the French seamen, on the 1st June, 1794, possessed the same skill in gunnery as the men who had been disorganized or dispersed, we may fairly doubt whether any of our ships would have passed through the French line. And making every allowance for ignorance, stupidity, and ineptitude, it is still difficult to understand why, on the "First of June," the *Montagne* permitted the *Queen Charlotte* to pass under her stern and to rake her as she did; or why, at Trafalgar, the *Victory* and the *Royal Sovereign* respectively were able to open their fire with such tremendous effect into the stern of the *Bucentaure* or *Santa Anna*. Only one instance occurs to me in which anything at all corresponding has been attempted against an English line. In the battle of St. Vincent, the *Principe de Asturias* endeavoured to pass ahead of the *Victory;* the endeavour resulted in a most disastrous failure, which may be considered as a satisfactory proof that the manœuvre of passing

through the line, such as was performed by the *Queen Charlotte* on the First of June, and by the leading ships at Trafalgar, was only a possibility against an incapable enemy; against ships in good order, with regard both to seamanship and gunnery, the attempt could entail nothing but loss and disaster. Nor can it be doubted that, had the French and Spanish ships at Trafalgar been efficiently manned and officered, our ships, advancing as they did, must have been dismantled long before they could come into close action.

For this reason, I would distinctly say that we cannot take the tactics so gloriously triumphant at Trafalgar, as theoretically sound, or as capable of any general application. That the genius of Nelson, estimating the inefficiency of the enemy, judged rightly as to the risk of such an advance, and as to the overpowering effect of it if successful, is a lesson indeed in the study of discipline and character, which may carry instruction to Commanders-in-Chief, without in any way preventing a student of tactics from commenting on the theoretical impossibility or extreme danger of the proceeding.

I am, therefore, warranted in saying that the theoretical study of tactics is essentially different from the practice. Theoretically, ships, guns, men, are equal; ships do not miss stays; guns do not miss their aim; men do not lose their nerve, but act with

coolness and judgment: practically, there is a vast difference: and if on land, so also at sea, victory is generally the reward of the commander who makes fewest mistakes.

I would be particular in calling attention at the outset to this important difference between the theory and practice of tactics and evolutions. We cannot take into exact account the varying imperfections of ships and guns, or the very different abilities of Commanding Officers; whilst in practice, these are points of the greatest importance, the knowledge and observation of which will guide and direct the Commander-in-Chief, as much as any purely theoretical ideas he may have formed. Still, to know what, under even ideal circumstances, can be done, is a great point; to know what ships thoroughly efficient can and ought to do, is at least to know what to aim at: the previous consideration of whether, with existing ships, guns, men, and officers, certain evolutions can be performed with a fair chance of success, will awaken attention to the detail of the risks to be run or to be avoided, or to the necessity of modifying or altering preconceived plans of attack or defence.

Under the constantly changing conditions of wind and weather,—conditions which cannot be ignored, even though we do treat of steam ships,—with the countless diversities of number, quality, speed, armour, armament, of the ships which may be in company, or

which may be opposed to each other, it is impossible to attempt any purely general solution of the problems which the conduct of ships-of-war, in action, in the open sea, presents to us, or, within reasonable limits, to enter on the questions in complete detail. I would, therefore, claim the right of assuming certain fixed data: as, for instance, that the opposing fleets are equal; that the ships and their capabilities are equal; and that the men, also, are equally to be relied on. Leaving on one side, for the present, the necessary inequalities and difficulties which form such an essential part of our practical study, I would wish to consider our ships and fleets moving, as directed by one mind, with the precision of a chess-player's gambit.

CHAPTER II.

THE SINGLE SHIP.

1. *Manœuvring Capabilities.*

THE earlier writers on steam evolutions, exulting in their liberation from the doubts and delays of tacking or wearing, have ignored the difficulties incidental to the more certain manœuvres under steam; and have represented a ship as altering course abruptly, and at a sharp angle, through any required number of points. They have, in both their writings and illustrations, overlooked the fact that a ship does not and cannot turn thus abruptly; that one ship, for instance, cannot fall into line astern of another by simply coming into her wake, at the proper distance, and changing course, in the manner officially prescribed for the French Navy in several of the manœuvres in the "Tactique Navale" of 1857, and in other works—French, English, or American.

It is now generally understood that a ship, in altering course, does so, not at a sharp angle, but by traversing the arc of a circle through the required number of points; that in turning completely round,

coming back with her head in the original direction, she describes the whole of this circle, and arrives approximately at the very spot from which she started; but that in the course of this circle, she covers a great deal of ground; that, with a long heavy ship, this circle is very large, having in some instances a diameter of from a thousand to fifteen hundred yards; that a ship, in reversing her course, is thus necessarily brought to the farthest extremity of the diameter of her circle, and is thrown altogether out of her former position; and similarly, that in changing course through any angle, the corresponding change in position is considerable.

It must, however, be distinctly noted that the curve described is not an accurate circle; that the ship, in turning completely round, does not come back exactly to her initial position, and may be at a very sensible distance from it. The fact is, that when the helm is ordered to be put over, the ship is moving in a straight line, which her momentum seeks to continue: it is only by degrees that she yields to the rudder; but the rudder itself is put over but slowly, and the curve, which the ship is gradually compelled to follow, changes as the angle of the rudder changes, being always some time behind it; and does not attain its limiting curvature till after the helm is fully over. It is thus, in its early part, a spiral, not a circle; its difference from a circle depending partly on the weight

of the ship, as giving her a greater or less momentum; but principally on the time requisite to put the helm over.

It is, therefore, perfectly clear that the more the time of putting over the helm to its extreme angle can be shortened, the more nearly does the curve approach to a circle, and the less becomes the nominal circle of evolution in both diameter and time. We know, also, that the diameter and time decrease as the helm angle increases, up to 45° or 50°; and there is, therefore, a manifest loss of manœuvring power in having the helm so fitted that it cannot be put over beyond 25° or 30°, as is the case in most of our ships; whilst to attain even this angle, when the ship is at speed, requires the united efforts of many men, and the expenditure of much valuable time.

It seems, therefore, an absolute necessity that some very different method, both of fitting and working the rudder, be brought into use. In some of our newer ships, steam power has been applied, but with no success that can be fully depended on. For such purposes, it would almost appear that steam is not sufficiently under control; and I am not singular in the belief that hydraulic power would be found more manageable, and altogether better suited. Of the many plans that have been suggested or tried, I know of none which seems, on the whole, so serviceable, so safe, so unobjectionable, as the hydraulic apparatus

designed by Admiral Inglefield, and tried by him, with most satisfactory results, on board the *Achilles*, when one man put the helm over to 25° in 10 seconds whereas, on the official trial, 14 men took 1 min. 30 sec. to put the helm over to 23°. If this, or some corresponding apparatus, is once fairly adopted, any small imperfections, afterwards coming to light, will be quickly remedied by the practical ability of our large Engineer staff, which would be brought to bear on it; and to wait for the machine to be tested as to absolute perfection, before allowing it to be introduced, seems a false and delusive policy.

It is, however, on the assumption that the described curve is a circle, that Admiral Bourgois, of the French Navy, has detailed an experiment conducted by the late Count Bouet-Willaumez, in order to show that a ship, in describing her circle, continually heads inward towards the centre. The observations, made on board the *Solferino*, an iron-clad two-decker, were as follows:—

Two observers, one aft, one forward, at a distance of 72 *mètres* (about 240 feet), took, simultaneously, every 10 seconds, the mast-head angle of the *Caton*, a small vessel anchored near the estimated centre of the circle. These angles, when the calculation was made, showed that the bow and the stern described two different circles; and in three out of four experiments, the circle of the bow was the smaller of the two; in

the other experiment, at slow speed, it was the larger. The figure given by M. Bourgois, in illustration of this, is here shown (Fig. 1). He says, that if *RD* and *VB* are the circles described by the stern and bow, then, if any position, *R*, of the stern be taken, a small arc, described with centre *R* and distance 72 *mètres*, cuts the inner circle in *V*, which must be the corresponding position of the bow.

The description of these experiments with the *Solferino* is, however, far from satisfactory. The observations themselves are not given; so that it is impossible to form an opinion respecting the method or the accuracy of the reduction—a process which must have, necessarily, been somewhat complicated. No bearings or horizontal angles seem to have been taken, either from the positions on board the *Solferino* or on board the *Caton*; yet, without them, the results obtained cannot be considered certain: no explanation is given of the very curious—we may even say, suspicious—discrepancy between the observations: and, above all, no mention is made of the direction in which the circles were described; whether they were all to starboard, or all to port, or alternately: the fact that the circle to starboard differs from the circle to port, is simply ignored.

The statement, then, of the peculiar position which the line of keel takes with reference to the circle described, rests on three out of four experiments, the

accounts of which are incomplete; which were, in themselves, imperfect, and made with only *one* ship. Such evidence cannot be held to be conclusive; although it may be admitted as raising the question, and suggesting further inquiry.

Theoretically, it does not seem to me possible for a ship to describe a circle, if the line of keel is inclined inwards in the manner represented. If she moves stem first, she must describe a spiral, continually drawing nearer to the centre: if she describes a circle, she must move obliquely, broadside on: and our experience, imperfect as it is, is sufficient to permit us to say that she does neither of these things; that she does not move broadside on; and that she never arrives at the centre. But we have seen that she does, in fact, for a time, during the early part of her turning, describe a spiral; and with a heavy ship, such as the *Solferino*, the spiral nature of the curve may easily be supposed to have extended over a very large proportion of her circuit; so that, allowing the experiments described their utmost value, I would conceive that, during the greater part of the time of observation, the ship really was running in the initial spiral; not in a circle, as represented.

Since, then, a ship, in turning, really runs in a spiral, not in a circle, and as this spiral is subject to so many and complex changes, it is difficult to define exactly what the track of the ship is. It is commonly

spoken of as a circle, having a diameter determined by the distance run considered as the circumference; and though it is, in reality, not a circle, it does not, in general, differ more from one than may be readily allowed for. It must, though, be borne in mind that the arcs prescribed, in performing certain manœuvres and evolutions, are calculated on the hypothesis that the sweep is accurately a circle; and that the results, therefore, are by no means mathematically correct, even if the manœuvres have been performed with the utmost precision.

Many attempts have been made to formulate the relations between the diameter of the described circle and the helm angle, in terms of the length of the ship, the area of the longitudinal section, the area of the rudder, or other dimensions selected according to the fancy of the student: they seem to me all equally unsuccessful. As one instance of this, I may mention the empirical formula lately proposed by M. Lewal, Captain in the French Navy, which is

$$d = A \cot^{\frac{2}{3}} a$$

where A is the diameter of the circle described with a helm angle of 45°,

and d is the diameter corresponding to helm angle a.

The constant A is determined by substituting any observed corresponding values of d and a; from which determination any other corresponding values of d and

a are easily calculated.

The formula is certainly neat and simple; but it has the disadvantage of not being true. From M. Lewal's own tables, we find that the differences between the calculated and observed diameters, varying considerably, range up to 266 *mètres*, or nearly 300 yards! that these differences are not only extremely variable in magnitude, but also in direction, being sometimes in excess, sometimes in defect; and that of 14 examples given, probably as the best suited to support his argument, the mean difference is 91 yards.

I would certainly hold, then, that the formula proposed by M. Lewal is worthless, from any practical point of view; and I have not met with any other, out of many which have been proposed, which can be considered as superior to it. It seems, indeed, probable enough that there is a relation of the kind which it has been sought to establish; but either from the imperfection of the assumed data, or from some other cause, it has not yet been detected; and we are thrown back on the necessarily inexact methods of experiment and observation. Carefully noted, however, these are sufficiently correct for practical purposes; and their results, freely interpreted, admit of our applying to them the mathematical properties of the circle, but with the distinct understanding that the distances and bearings so obtained are only rude approximations, which must be corrected by the judgment and skill of

the commanding officer who has to apply them.

The size of the circles which a ship describes, is, then, a point to be determined by experiment. These circles differ according to the trim of the ship, being smaller if she is down by the head; they differ at different speeds, and with different helm angles; they differ, also, according as the ship turns to starboard or port; and they should be exactly determined by repeated observation, as soon as possible. In manœuvring even two ships together, it is essential that they should be able to turn together in circles of the same diameter; and it is, therefore, necessary that they should be able to regulate their helm angles, so as to do so. This is easy, after a little practice, when the diameters corresponding to the several helm angles, at different speeds, have been accurately ascertained; but, till these have been tabulated, anything like uniformity in manœuvring is out of the question.

A point quite as essential as equality of the turning circles, is equality of speed; and to arrive at this, some method of measuring the speed, at any moment, is absolutely necessary. For this, the common log is utterly useless; so is the patent log. It is quite clear that, though the patent log tells, with fairly approximate accuracy, the distance the ship has passed over in any given interval, and is thus of great value in establishing the data for the Dead Reckoning, it can give no information as to the various speeds at which the distance

has been traversed, or the actual speed at any single instant. The common log can do so roughly; but its frequent use is troublesome, and its determinations inaccurate. The plan that has been found most successful, when ships are steaming in company, for determining, not the actual speed, but the equality of speed, is by the number of revolutions of the screw. Each revolution of the screw causes the ship to advance a certain space, assumed to be constant; hence, for a required speed, the screw must make a certain known number of revolutions per minute. This number being determined by experiment, the ratio between the number of revolutions of one ship and of another, at the same speed, is found, and forms a constant coefficient; so that if one ship signals the number of revolutions she is making per minute, her consort, applying this coefficient or constant multiplier, makes the corresponding number of revolutions, and preserves an equality of speed. Experimentally, this has been found to work well. I have no record of observations made in our own fleets; and I believe the system has never been carried out in its entirety—that is to say, the signal made is the number of knots, and the individual ships are left to keep that speed as best they can. The French have adopted the plan of signalling the number of revolutions; and M. Bourgois and other tactical writers speak most positively in favour of the result.

But, whilst there can be no doubt that determining

the equality of speed by the number of revolutions is decidedly preferable to the guessing at it, incidental to any other used method, it does not seem to me altogether satisfactory, and might not be found to answer in active service, when the foulness of the ships' bottoms, the difference of trim, or some one of the numerous causes of change to which ships at sea for a long time are subject, might alter the coefficient of speed very considerably. It would, thus, be most important to have a ready way of checking the accuracy of this coefficient—that is, of ascertaining correctly the speed of the ship at any instant. There cannot be any real difficulty about this: several methods of doing it have been proposed, which would answer the purpose very well; but they have not come into use, simply because it has seemed sufficient to jog along in the old groove, and determine a ship's speed in much the same way that Vasco da Gama and his forefathers were wont to do. Conservatism may be carried too far; and the manners and customs used at sea may sometimes be altered with good effect.

The simplest proposed method of determining the speed at any instant, with which I have become acquainted, is to allow the common log-ship, having the lanyards to its corners securely fastened—that is, without any slip-peg,—to float astern with sufficient drift, and to lead the log line to a strong spring-balance. The pull on this may readily be converted

into speed by the equation—

$$V = m\sqrt{P},$$

where V denotes the speed required, in knots, per hour;

P, the observed "pull" in pounds;

and m, a constant coefficient, determined by experiment.

Such a method could not, however, be accurate, unless the ship was running in a straight course: the indications, when the ship was turning circles and parts of circles, could scarcely be relied on. Under all circumstances, whether on a straight course, or on a curved one, the most satisfactory instrument that I know of, is Berthon's log: its indications have, I believe, been found most accurate; and its construction is so simple that any accident to it may be easily repaired by the ship's artificers. It was invented by Mr. Berthon many years ago, and has been allowed to lie by, neglected and, perhaps, forgotten; but I would suggest that the manœuvring capabilities of a ship would be increased, at a mere trifling cost, by fitting her with one of these instruments; and that it would be advantageous so to lead the pipes, as to indicate the speed at once in the engine-room and on deck. The thing has been so completely shelved, that no attempts have been made to improve on it, or to render it more perfect in its details; and this double indication has never, I believe, been fitted: still, I do not think any

mechanical difficulty will stand in the way, if once attention is turned towards it.

Knowing the diameter and time of the ship's circle, and her speed on a straight course, it is easy to lay down the movements and the time necessary to execute any change of position; it is a mere matter of elementary trigonometry. It is, however, impossible, in the midst of performing manœuvres, to work out even the very simplest questions of this kind: they must all be worked out previously; and the results, neatly tabulated, should be pasted on a board, kept on the bridge or in the conning tower, ready for immediate reference.

If a denote the radius of the circle which the ship describes, then, in changing course through an angle θ, the ship is put a distance $a \sin\theta$ ahead of her former position, and a distance a vers θ to starboard, or port. These values should be worked out, both to determine the distances corresponding to any given value of θ, as well as to show the value of θ for any required change of distance. As relates to manœuvring in company with other ships, the changes of position to starboard or port are the most important; the distances ahead being easily regulated by subsequent changes in the speed.

In moving to take up a position to starboard or port, heading in the same direction; as, for instance, in closing on a ship a-beam, the ship must describe two

sweeps opposed to each other, each of which takes her half the required distance. Suppose, for example, that she has to take up a position, at a distance a, to starboard; the distance which she makes on each sweep is $\frac{a}{2}$, and we have, to determine θ

$$\frac{a}{2} = a \text{ vers } \theta,$$

$$\text{or vers } \theta = \frac{1}{2} = \cdot 5,$$

$$\text{whence, } \theta = 60^\circ.$$

Moving from A (Fig. 2), she describes an arc of her circle through 60°, to position B; and reversing her helm, describes another arc of 60°, in the opposite direction, to position C. Thus, in position B, she is a distance $AM = \frac{a}{2}$ to starboard of A; and, in position, C is a distance $CN = MO = \frac{a}{2}$ to starboard of B. At C, she is, therefore, altogether, the distance $AO = a$ to starboard of A, her initial position; and is also the distance $OC = \sqrt{3} \, . \, a = \frac{7a}{4}$ (very nearly) ahead of it. The time required for this change of position is the time the ship takes to describe the double arc ABC, which is twice the time of describing the arc AB, or one-sixth of the circle; so that, if t denotes the time, in minutes, in which she describes the whole circle, the time required is approximately $\frac{t}{3}$.

Some such manœuvre, as this I have just described, is necessary whenever ships, in line abreast, have to open or close on each other. It has, therefore, a peculiar importance in all questions relating to the evolution of squadrons or fleets; and, on that account, it seems not out of place to give the angles, corresponding to those changes of distance, which will be most often required. As thus:—

Distance gained to starboard or port.	Angle of each arc.
$\frac{1}{4}a$	28° 57′
$\frac{1}{3}a$	33° 33′
$\frac{1}{2}a$	41° 25′
$\frac{2}{3}a$	48° 11′
$\frac{3}{4}a$	51° 20′
a	60° 0′

In all calculations of time and distance, in reference to the manœuvring of single ships, or the evolutions of squadrons or fleets, it will be convenient to consider the radius of the circle, on which they are to manœuvre, as the unit of distance. Ships ought to be able to manœuvre within that distance of each other; and though on first forming a number of ships into a fleet, it may be necessary or expedient to keep them in more open order, a very few days practice in company ought to render the closer order perfectly feasible. It has of late years come to be considered unsafe to manœuvre iron-clads at a less distance apart than two cables; but

this is approximately the radius of the circles described by such ships as the *Warrior, Minotaur,* and others; beautiful specimens, possibly, of naval architecture, but which, as men-of-war, we cannot but consider as mistakes, and which, we may trust, will never be repeated. Later ships, such as the *Bellerophon, Monarch, Hercules,* or *Sultan,* all differing considerably amongst themselves, may yet be so far classed together, that they are all of comparatively moderate length, and describe circles, which though still very large, are much smaller than those of the elongated monsters which preceded them; and I am making sufficient allowance when I fix the circle, which these and other first-class ships can describe in company, as having a diameter of 600 yards, or a radius $a = 300$ yards; and this value of a I shall consider as the evolutionary unit of distance.

The speed at which a ship should perform manœuvres has been the subject of much discussion; on the one hand, it seems right that the manœuvres should be performed at the highest possible rate of speed; on the other, that the ship should, as a rule, have a large reserve of speed available, so as—for instance—to be able to describe larger arcs, or to cover more ground than her consorts, without causing delay. On these considerations, a speed of 8 knots seems a good mean; which is taken as such, with the understanding that the ship has a reserve of speed ready, and that she can,

if necessary, move at the rate of 10 or 12 knots.

I have dwelt on these points of the determination and measurement of circles and speed, because it is essential that the capabilities of each ship, in these respects, should be fully known and understood, before she attempts to manœuvre in concert with others. If ships in company cannot, with reasonable accuracy and precision, describe equal circles; if they cannot move at equal speed, or at any named speed ordered by signal; if they cannot take up assigned positions, determined by bearings and distances,—the result cannot be anything but confusion; the fleet is merely a crowd of ships, as dangerous to each other as to a possible enemy.

2. *Armament.*

THE offensive power of a fleet, although entirely made up of the offensive power of its component ships, is not by any means a simple product of that power, but is an irregular and altogether unmathematical function of it, varying, within wide limits, according to the application of the several units. At present, we have to examine into the unit of capability: how to intensify the collective value of the function of that unit will be a problem for later investigation.

All history and tradition, for the last three hundred years, points to the great gun, as peculiarly the naval weapon; and by it all naval battles have been decided; the instances to the contrary, where boarding has played any important part in the issue of the fight, as perhaps in the battle of Cape St. Vincent, are very exceptional, and do not in any way controvert the general statement. We therefore still naturally look to the great gun as the distinctive armament of our ships; and during these last few years our professional conservatism has received a rude shock by the extreme diminution of the number of guns carried by a "first-rate." From the 130 guns of the *Duke of Wellington* to the 8 of the *Hercules*, the change is enormous; and not only in the number, but correlatively also in their size and power. It is by reference to this last that the value of the change is supported; and it is, correctly enough, maintained that the armament represented by these few modern guns, is far more powerful than that represented by the many guns of other days. There is no denying this. The destructive capability of the *Hercules*' broadside is greater than that of the *Duke of Wellington's*—if only it takes effect; but a concentrated broadside of the *Duke of Wellington*, striking on the waterline, would have sunk any ship then afloat; whether that of the *Hercules* would be equally fatal, may be doubted. In the days of wooden ships, a shell striking, even at a very acute angle, was tolerably

encumbrances? Very far from it! A gun that can drive a shot against the enemy's side with a force of nearly 5000 foot-tons, is a weapon of vast capabilities; but these capabilities are not those which our penny-a-liners love to write about. The sinking an enemy's ship by a broadside, almost before she can be seen, is a grand theme for the cheap newspapers; to us, who may pretend to some reasonable acquaintance with the subject, the broadside, at the closest possible quarters, seems much more likely to effect the object.

I am, thus, distinctly of opinion that the fire should be reserved till the enemy's ship is at a very short distance. What the actual limit to that distance should be must depend on many attendant circumstances; but I think that 400 yards ought not to be much exceeded. Let us consider the effect. At 400 yards, well-trained men may make certain of hitting: each shot must tell, and that with an energy of 4700 foot-tons. If it could be carried out, my idea would be to have all the guns of the broadside carefully laid by concentrating marks, and fired simultaneously by an electric discharge. The shot, striking on a very limited area, with an energy of 20,000 foot-tons, must break down anything opposed to them. Such a concentration has never been tried but I doubt the resisting power of the strongest armour yet imagined.

Even, however, if it should not thus break down the ship's side—a possible though improbable suppo-

sition,—a blow of such intensity must seriously affect her movement. This, again, has never been tried—cannot be tried until it is so in the crash of actual fight; but it may fairly be maintained, even without positive experience, that a blow of 20,000 foot-tons, delivered on a ship's bow, and not penetrating, would turn her rudely out of her course; it would cause her to yaw in the wildest manner; and place her in a position to be run down without difficulty.

One or other of these things ought to happen: the ship ought to be sunk by the concentrated broadside, or be fatally rammed in consequence of it. We know that

> "The best-laid schemes o' mice and men
> Gang aft agee;"

and that things that ought to take place, very frequently do not. And thus, the broadside may not take full effect; it may even miss altogether; and possible neglect may render the attempt at ramming futile; but, in a theoretical discussion, contingencies such as these may fairly be omitted: a reasonable amount of technical skill, energy, and nerve may be pre-supposed; and we cannot allow any place to gross ignorance and ineptitude.

The obvious objection to such a use of the guns is that it might entail the necessity of sustaining the enemy's fire unanswered, for some time. But if, as I have said, distant aim is so uncertain, and the proba-

bility of distant shot glancing is so great, the same uncertainty, the same probability, affects the enemy in the same degree; and a disregard of them will only smother him in his own smoke. The damage such distant fire can inflict upon a heavy iron-clad, is not likely to be serious, and under any circumstances, not involving absolute destruction, our men, when well disciplined, have always shown an extraordinary coolness and stedfastness in the critical moment.

3. Effect as a Ram.

HAVING thus briefly considered the use and effect of the great gun in future naval warfare, it becomes necessary, in investigating the fighting capabilities of the single ship, to examine into her efficiency as a ram; the more so, as all our later ships have been built with direct reference to such a mode of attack, and have had their bows shaped and strengthened accordingly. In days yet to come, when our naval architects, aiming at "handiness" as the most desirable offensive quality of a ship, have rendered possible a precision and quickness in manœuvring far beyond our present understanding, it may be a question whether, with a weapon so formidable as the ram, the great gun should not be virtually laid aside; but the time for

such a question has not yet come; the gun must still be held to be, primarily, the armament of our ships though, secondarily, the ram must enter largely into any scheme of battle, and of offensive or defensive evolutions.

Experimentally, we know so very little about the power of the ram, that it is impossible to speak, with any certainty, of the limits within which it is effective; but we may be permitted to assume that, against a strongly and heavily built ship, such as an iron-built iron-clad man-of-war of the present day, the striking force must be very great. We have absolutely no data to enable us to assign an inferior limit to this striking force; the only instance with which I am acquainted that seems to bear at all on the question, is the ineffectual attempt made by the *Merrimac* to ram the *Monitor* in the fight in Hampton Roads, on the 9th March, 1863. The *Merrimac*, steaming directly at the *Monitor*, struck her on the side; "but the *Merrimac's* ram was broken, and her weak engines were insufficient to propel her with the necessary speed; consequently she inflicted no damage, a slight mark on the iron plating being all the sign left of the impact of so heavy a body." [*Fletcher's History of the American War, vol. I, p. 334.*]

Now, the *Merrimac* was a ship of very considerable displacement; and she was able to steam into the fight, to move freely about the roadstead during the fight,

and to steam away after the *Monitor* withdrew: we may, therefore, fairly suppose that she could command a speed of from 3 to 4 knots. Since, then,

$$\text{Striking force} = \frac{W}{2g}v^2,$$

where W denotes the weight of the striking body,
v, its velocity in feet per second,
and g, the acceleration in feet per second, due to the earth's attraction;

if we assume, in this instance,

$W = 4000$ tons,
$v = 6$ feet, corresponding to a speed of $3\frac{1}{2}$ knots.
and $g = 32$ feet,

we have,

$$\text{Striking force} = \frac{4000}{64} \times 36$$
$$= 2250 \text{ foot-tons};$$

and we may, therefore, infer from this experience that a striking force of 2250 foot-tons is utterly insufficient to produce any decisive effect. Now, the *Monitor* was a small, hastily-built ship, probably of no great strength as to her internal fittings and bracings; so that we must conclude that, against a well-built vessel, the striking force, to be effective, must be not less than 5000 foot-tons, which requires, for a ship of 6000 tons displacement, according to the formula just given, a minimum speed of about $4\frac{1}{2}$ knots.

It is however impossible to say that the experience

on which this calculation is based is of any certain value. The effect of the striking force must obviously depend on the area over which it is dispersed; and though we might assume that this area is approximately constant for ships having ram bows, the *Merrimac* was not so built, and whatever fitting she had seems to have been damaged, when, in the fight of the previous day, she sunk the *Cumberland*. It, therefore, is by no means improbable that our data are altogether untrustworthy; and indeed, the general opinion has been that a striking force very much less than 5000, or even than 2000 foot-tons is sufficient. This opinion, again, is probably based on the results of certain well-known collisions, in which the stricken vessel has sunk, although the blow has been, to all appearance, extremely slight; as was the case with the American steamer *Oneida* off Yokohama, in January, 1870, and as was the case with the *Northfleet* off Dungeness, this very last winter. But these were both vessels of slight scantling; and in both instances, the vessel that cut the other down was a fast steamer with fine entrance, having an almost knife-like stem; thus concentrating the striking force on the smallest possible area. This sharpness of the stem on the one hand, the weakness of the scantling on the other, must be duly borne in mind when we consider the effect of what has been spoken of as *a slight blow*. It by no means appears that the blow was so very slight. A

steamer of possibly 2000 tons displacement, at a speed of five knots, has a striking force of rather more than 2000 foot-tons; and the concentration of this blow on the knife-like edge of the stem rendered it still more effective; whilst the very slight resistance offered to it by the weakness of the vessel struck gave no sensible shock to be felt by the people on board. It seems therefore, that so far as our present enquiry is concerned, no reliable conclusion can be drawn from these melancholy accidents; but, on the other hand, during the last summer, a large sailing ship, the *Hoghton Tower* under all plain sail, and with a leading wind, ran into Her Majesty's ship *Caledonia*, an iron-plated wooden ship, stout enough, no doubt, but entirely without that system of bracing which gives our latest iron ships such enormous strength. From the known size and speed of the *Hoghton Tower*, we may confidently estimate the striking force as not less than 2000 foot-tons, and that given by a sharp stem: the injury sustained by the *Caledonia* was extremely trifling; but the merchant ship had her bow stove in.

The only real experience which we have of the power of the ram, as a weapon of modern war, is that which is given by the successful attack of the *Ferdinand Max* on the *Re d'Italia* in the fight off Lissa. These ships were both of about the same size and type as the *Caledonia*, just spoken of; and without any fitting or strengthening of the bow, with a view to its acting

as the effective point of a ram. Whether by reason of damage done to her rudder, or because her captain simply "lost his head," the *Re d'Italia* got in the way of the Austrian flag-ship; seeing this, Tegethoff shouted down the tube, "Full Speed ahead!" and charged. Under the weight of the blow, the *Re d' Italia* heeled over through 45°, and received the enemy's blow through her unarmoured bottom. Reversing her engines as soon as the blow was struck, the *Ferdinand Max* backed out of the hole she had cut for herself; the *Re d'Italia* righted with a heavy roll, and went almost immediately to the bottom. In the reports made at the time, it was said that the *Ferdinand Max* had a speed of $11\frac{1}{2}$ knots; and this is repeated in every account of the battle which I have seen; but judging from the very short interval which elapsed between the order for Full Speed, and the impact, it seems scarcely possible that her speed can have exceeded 8 knots; which, with a displacement of 6000 tons, would represent a striking force of rather more than 16,000 foot-tons.

If it is impossible to fix, with any precision, the limiting effective value of the striking force, it is evidently also impossible to fix the limiting angle of impact. If, however, we may assume the former at 5000 foot-tons, as I have suggested, to deduce the least effective value of the angle of impact is easy enough.

Let θ denote the angle of impact, that is, the

horizontal angle between the line of keel, and the surface against which the impact takes place. Then we have—

Effective, or normal striking force
= striking force due to normal velocity;
that is, for the least value,

$$5000 = \frac{W}{2g} v^2 \sin^2 \theta,$$

$$\text{or } \sin \theta = \sqrt{\frac{320{,}000}{Wv^2}}.$$

Hence, by increasing the velocity, we diminish the limiting value of the angle, which becomes the least possible, when the velocity is the greatest possible. Thus, for a ship of 8000 tons displacement, if we assume the greatest velocity as 20 feet, corresponding to a speed of 12 knots, we find the least value of θ to be $\sin^{-1}(\sqrt{\frac{1}{10}})$ or 18° nearly; whilst at 8 knots it becomes 29°, and at 4 knots is about 72°.

In studying the capabilities of an individual ship in time of war, or with reference to tactical manœuvres, it would be well to have this angle of impact calculated for different rates of speed; so that by knowing exactly when effective ramming is, or is not, possible, golden opportunities may not be allowed to slip, when they might be grasped, by duly increasing the speed. But in all cases of ramming, it is well to err on the safe side; better to let the blow be too strong, than too weak; and to bear in mind that the striking force

increases proportionately to the *square* of the velocity; that the ship, like fame, in the words of the old poet, which stand at the head of these pages,—*vires acquirit eundo.*

So many very opposite opinions relative to the manner and efficacy of ramming have been published, that it is impossible to express a decided conviction on the subject without running counter to some of them. It has thus been said very positively that the effect of the blow on the ship which gave it would be nearly as ruinous as on the ship which received it; that her masts would go by the board; her engines be forcibly torn from the bed-plate; her guns be upset, and her men sent flying. The experience of the *Ferdinand Max* contradicts all this; the shock, as felt, was extremely slight, and all the damage she sustained was a trifling leak, due to the imperfect fitting of her bow. It has, again, been said that though the force of the blow might make a hole in the ship's side, yet the modern system of compartments and bracing renders the hull so strong that the damage might not be fatal, and that the ship would be, possibly enough, able to haul off, and, with her guns, continue the fight. It is difficult to form an opinion, when there is no satisfactory experience as a basis for it; but all analogy leads me to believe that a direct blow, delivered by a ship, such as (say) the *Hercules*, of 8000 tons displacement, at a speed of 12 knots—that is, with a kinetic

energy of 50,000 foot-tons—would require no repetition. I believe that the attacking ship would cut clean into her antagonist, scarcely feeling the blow more than did the *Bombay* or the *Murillo*; that the sinking of the vessel so struck, would be the affair of a few seconds, or, at most, minutes; and that it is a question which only deadly combat can decide, whether the striking ship would not pass through and over the shattered wreck.

When a weapon of such a deadly nature is brought into action, it becomes of the utmost importance to understand fully its uses and capabilities; to learn equally the attack and defence. This knowledge is to be acquired by exercise alone; and practical skill, aided by cool judgement, a quick eye, and (in the words of Captain Goodenough) "a sound digestion," will avail more for their development than the study of mere theoretical manœuvring, which can only be considered as humbly ancillary to them.

CHAPTER III.

THE SQUADRON AS THE TACTICAL UNIT.

FOR purposes of evolution, a fleet must be defined as a number of ships capable of acting together, of manœuvring together—when necessary, of fighting together; we must suppose them equal, or nearly equal, in their several capabilities: but the actual capabilities of the worst of the number must be taken as the representative capability of a fleet. Thus the maximum speed of the slowest ship is, effectively, the maximum speed of the fleet; the circle of the ship which describes the largest, is, effectively, the circle on which every ship in the fleet has to manœuvre. It is thus evident that by associating, in the same fleet, ships of widely different capabilities, there is much loss of manœuvring power; the fleet has to perform its evolutions on the basis fixed by the slowest and least handy of its members; and might, perhaps, occasionally be strengthened by the ejection of some one or two ships, whose inferior power of manœuvring seriously diminished the efficiency of the fleet as a whole. Ships

so ejected might form a reserve, to act in time of battle according to the orders of the Admiral, auxiliary to, but independent of the formation of the main body.

The manner in which a fleet should be divided for evolutionary and tactical purposes has been much debated. An opinion which, in different forms, has been commonly put forward, is that the division should be according to some definite fraction of the whole; that one-half, one-third, or one-fourth of the fleet should form the tactical unit; or that, dividing the fleet into halves or thirds, these should be subdivided into three or two parts. The principle of these proposals seems to me erroneous, and to render evolutions needlessly complicated, by making the unit of evolution a variable quantity depending on the number of ships got together for the fleet.

In distinct opposition to this, I would propose that the unit of evolution be considered a fixed quantity; that is, that a *squadron,* under the immediate command of its Admiral or Commodore, consist of a certain fixed number of ships, and that the number of squadrons in the fleet be a number altogether variable, depending on the power, or intention of the Admiralty. It may be an open question as to the best number of ships for such a squadron to consist of. The number *four* has had many and able advocates; I think *three* is preferable; and for these reasons:—

(1.) In every possible formation of three ships, each ship is (or may be) immediately next to the Admiral of the squadron, and can without difficulty, or chance of mistake, see his signals, or be even more readily communicated with, either by semaphore, black board, or otherwise. It is well known, for instance, that the signalmen of adjacent ships habitually and freely interchange gossip with each other by means of their fingers and arms; and there would be no diffiulty in recognizing this ability, cultivating it, improving on it, and utilising it for the good of the service.

(2.) The Admiral of the squadron, being always next to the ships of his own command, is immediately supported by them in action.

(3.) Three ships can act with more perfect unanimity than four; and more especially, because a fourth ship cannot be immediately next to the Admiral; cannot so readily and certainly see his flags or signals, and cannot be communicated with in the more rapid way I have suggested.

(4.) The peloton of three ships is a strong formation, whose strength is not increased, in the full proportion, by the addition of a fourth. The peculiar strength of the peloton will be discussed, at greater length, in the course of a few pages; here, it is sufficient for my purpose to say that if three ships in company have the required strength, the addition of a fourth is a lavish waste of fighting power.

I would, therefore, define the squadron as consisting of *three* ships, under the immediate command of an Admiral, Commodore, or Senior Officer, and constituting, in a secondary degree, the unit of evolution for the fleet. In thus dividing the fleet, attention should be paid, as far as possible, to the equality of the ships in each squadron, more especially in their manœuvring capabilities: these should exercise together; should learn to move as one; and should only be changed under circumstances of necessity.

The different formations, which it is possible for a squadron of three ships to assume, are but few; and with the evolutions and manœuvres necessary in changing from one to the other, every Commanding Officer should be perfectly familiar. If I enter here into the detail and discussion of some of these evolutions, it is because no way of performing them has, as yet, been officially recognized by the Admiralty: though some experiments have been ordered, it is still left to the discretion of every Commander-in-Chief to introduce any method which he may think best; and, as to which is the best, there is a wide diversity of opinion. As a guide in these details, I have laid down the essential principles of simplicity and regularity, even perhaps at the occasional loss of time: if at any moment during an evolution, which is being accurately performed, the ships are in no recognizable order, I consider (speaking generally) the detail of that evolu-

tion wrong in principle, and capable of being carried out, only when everything is going well, when all is quiet, and the mind or temper unexcited: but if, at every instant, the ships are in a clearly recognizable order, with distances and bearings distinctly marked, even if such an evolution requires a nominally longer time, its performance may be depended on, in emergencies of action, as in exercise, and is according to the general principle I have laid down. I shall, in the course of this disquisition, take occasion to examine critically into some of the various methods which have been proposed by competent authorities, with a view of showing their advantages or disadvantages; and proceed at once to the detail of certain of the more important evolutions of a squadron.

The only formations in which a squadron can be, are :—

(1.) Line ahead;

(2.) Line abreast;

(3.) Line oblique; *(a)* to starboard; when each ship is on the starboard bow of the one astern;
(b) to port; when each ship is on the port bow of the one astern;

(4.) Triangles, of different arrangement.

In all lines, the established distance between ships,

measured from mainmast to mainmast, is taken as the radius of the manœuvring circle, which we have, for our present purpose, fixed at 300 yards; any alteration of this distance is especially provided for. The length of a ship is taken as $\frac{a}{3}$ = 100 yards; and the manœuvring speed, on a straight course, as 8 knots; or 100 yards in $\frac{3}{8}$ of a minute. The reduced speed on the circle is taken as 6 knots, which gives the time of the circuit, $9\frac{1}{2}$ minutes, or a little less. The length of a squadron in line ahead, being two distances and one ship's length, is 700 yards; and the distance the squadron has to advance for the rearmost ship to occupy the water of the van-most, is two distances, or 600 yards; the time for which is $2\frac{1}{4}$ minutes.

I. The squadron is in line ahead; to change course in any given direction.

The leading ship signals to the ship astern as she puts her helm over; she turns through the required number of points and advances.

(Fig. 3, 4.) The second ship puts her helm over $1\frac{1}{8}$ minute after the leading ship, signalling, as she does so, to the ship astern; she turns through the required number of points, and advances, in the wake of the leading ship.

FIG. 1.

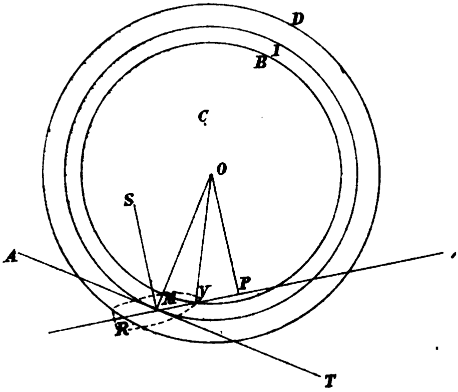


FIG. 2.

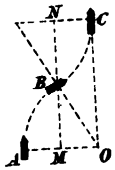


FIG. 4.

Squadron Evolutions I.

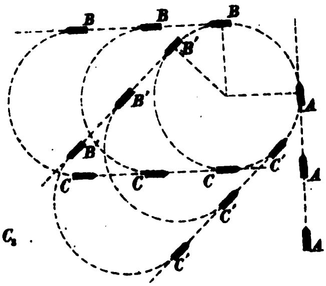
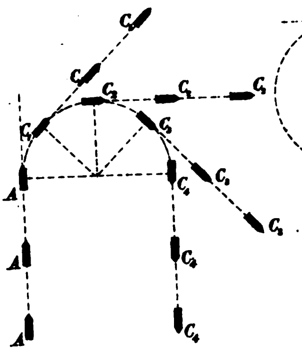


FIG. 3.

Squadron Evolutions I.



Robt. J. Cook & Hammond Lith. 29 Chancery

The rearmost ship does exactly the same, thus coming into line on the new course at the true distance.

I have here proposed to fix the moment of putting the helm over by *time*, which, if the speed is well regulated, is the most exact and the most comprehensive method. It may, however, be determined by change of bearing; in which case, supposing that the speed on the circle is three-fourths of the speed on the straight course, each ship puts her helm over when the ship next ahead is two points on the bow. But this rule, depending on the relative change of speed, is always liable to be inaccurate; it, also, only holds when the change of course is at least four points; and for smaller angles no satisfactory rule, based on change of bearing, can be given. The time of this evolution is $2\frac{1}{4}$ minutes, together with the time of describing the required arc; thus to change course through 8 points, or the fourth part of the circle,

time required $= 2\frac{1}{4} + \frac{1}{4}$ of $9\frac{1}{2} = 4$ min. 40 sec. (very nearly).

It has been proposed to perform this evolution in another way; thus:—

The leading ship takes ground to starboard.
The rear ship takes ground to port; or conversely, in the manner already laid down (page 33).

By altering speed, as necessary, the ships "dress" on the required line of bearing.

All together, put the helm over, and come into line ahead.

The objections to this method are manifold.

1st. The ships do not remain throughout in a recognized formation.

2nd. The distance taken to starboard or port is different for every different angle through which the course has to be changed, thus giving a different angle to be turned through; and this would be a probable source of mistake and confusion.

3rd. Although it has a more bustling and energetic look, it commonly takes a great deal longer; thus, to turn through 8 points would take—

Time of the double arc of $60° +$ time for rear ship to come into line abreast $+$ time of arc $90°$; or $\frac{1}{3}$ of $9\frac{1}{2} + 2\frac{1}{4} + \frac{1}{4}$ of $9\frac{1}{2} = 8$ min., nearly.

II. The squadron is in line-ahead; to change into line-abreast, on any given line of bearing.

(Fig. 5.) In line ahead, alter course to the given line of bearing, as in (I).

All together, each ship turns through 8 points coming into line abreast, at true distance.

FIG. 5.

Squadron Evolutions II.

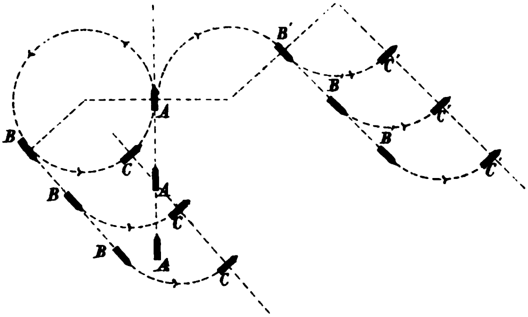


FIG. 6.

Squadron Evolutions III.

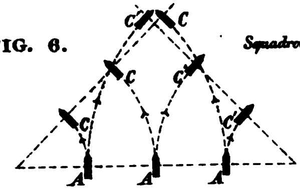


FIG. 7.

Squadron Evolutions IVa.

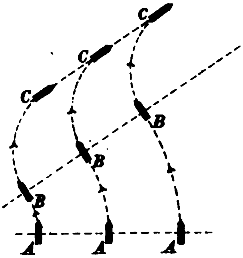
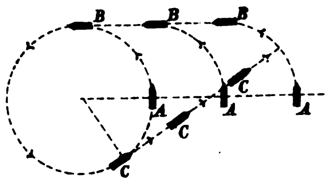


FIG. 8.

Squadron Evolutions IVb.



Robt J. Cook & Hammond Lith.

III. The squadron is in line abreast; to change front to any given line of bearing.

(Fig. 6.) The starboard or port ship of the squadron, as indicated, is the pivot. At a reduced speed of 3 knots, she describes an arc of her circle through the required change of bearing; the centre ship describes the same arc with a double radius, at a speed of 6 knots; and the third ship, with a treble radius, and a speed of 9 knots; thus "wheeling" into line on the required bearing.

To perform this important evolution with precision will require a good deal of patient practice, as well as a tried knowledge of the several helm angles. It will be seen, however, that, at every moment, the squadron should be in correct line abreast; and thus the outside ships may, to some extent, check their curve by the bearing and distance of the pivot ship. The time will be double that given, on page 56, for describing the fraction of the circle; for the pivot ship, which is moving on that circle, is at half-speed.

It is at once evident that the method of performing this evolution, which I have here given, and which is known as "By concentric circles," is not suited for a greater number of ships than *three;* even for a fourth ship, the circle of quadruple radius is too large, and a speed of 12 knots, on a circle, too great, to be depended

on; whilst beyond that, it is quite out of the question. When, therefore, a line abreast, of many ships, has to be wheeled, a method altogether different has to be adopted, which will be discussed, in due course, in the detail of fleet evolutions.

IV. The squadron is in line abreast; to change into line ahead on any given line of bearing.

This may properly enough be executed in two quite different ways, the application of which must depend on other circumstances.

(a) Wheel the squadron into the given line of bearing; the pivot ship as indicated,

(Fig. 7.) as in III.

All together, each ship turns through 8 points, coming into line ahead.

Otherwise,—

(b) All together, each ship turns through 8

(Fig. 8.) points, coming into line ahead.

In line ahead the squadron alters course to given direction, as in I.

According as the starboard or port ship of the squadron is made the pivot, in *(a)*, or according as the line ahead is formed to starboard or port, in *(b)*, the position of the squadron, in relation to the enemy or any danger, is altered; as may be seen by the figure.

V. The squadron is in line abreast; to form oblique

FIG. 9.

Squadron Evolutions Va.

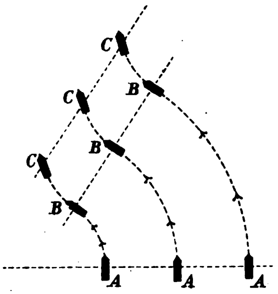


FIG. 10.

Squadron Evolutions VI.

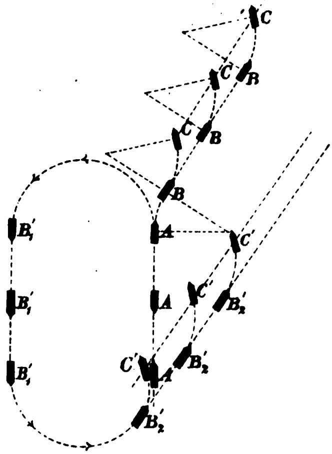


FIG. 9

Squadron Evolutions Vb.

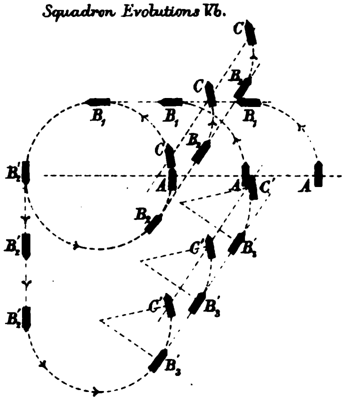
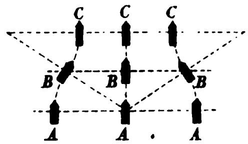


FIG. 11.

Squadron Evolutions VII.



line to starboard, (or to port), on any given line of bearing.

In oblique line, the lines of keel make with the line of bearing angles of 45°, unless otherwise indicated.

As in IV, this evolution may also be executed in two different ways, modified as may be desirable, according to the position in which it is wished to place the squadron; as is shown in the figures.

(a) As in IV *a*; substituting in the latter part the numeral 4 for 8, as the number of points turned through, which will bring the squadron into oblique line. (Fig. 9.)

Otherwise,—

(b) As in IV *b*; adding,

All together, each ship circles through 4 points, which brings the squadron into oblique line. (Fig. 9.)

VI. The squadron is in line ahead; to form oblique line to starboard (or port) on any given line of bearing.

In line ahead, the squadron changes course to the given line of bearing, as in I. (Fig. 10.)

All together, each ship circles through 4 points to port, or starboard, as indicated; coming into the oblique line required.

And conversely, if the squadron is in oblique line, form line ahead, and change course in any given direction.

VII. The squadron is in line abreast; to come into close order.

I would define *close order* to be at half distance apart.

(Fig. 11.) The outside ships of the line turn inwards through 41°; and, reversing the helm, turn through 41° in the opposite direction.

In performing this evolution, the ships take $\frac{2}{9}$ of $9\frac{1}{2}$ minutes, or $2\frac{1}{9}$ minutes; and at the end of it are $2a\sin 41°$, or 400 yards, nearly, in advance of their former position. Hence, while the outside ships are performing their part, the centre ship stands on at a reduced speed of 5·7 knots.

To open out again, the curves described are reversed; the reduced speed of the centre ship is the same.

VIII. The squadron is in line abreast; to come into *closed order.*

I define *closed order* to be at one-third of a distance apart.

As in VII, the angle being 48° instead of 41°.

The time occupied in this is $2\frac{8}{15}$ minutes, and, calculated in the same way as before, the centre ship reduces her speed to $5\frac{1}{4}$ knots.

IX. The squadron is in line ahead; to form line abreast, in *closed order*.

The leading ship turns to starboard;

The rear ship turns to port; *both* describe an arc of 33°, reverse the helm, and describe 33° in the opposite direction.

The time of performing this double sweep is 2 min. nearly, and the distance advanced by each ship is 330 yards. The centre ship has advanced about 500 yards, and is thus still astern of the leading ship. The leading ship, therefore, reduces her speed; so does the centre ship, as she comes abreast; the rear ship advances into position.

Before a squadron can safely manœuvre in *closed order*, it must be very well together, and able, therefore, to perform evolutions in a manner not quite so simple as has hitherto been insisted on. Thus I have here ventured to depart from the principle which I broadly laid down at starting—viz., that the squadron should, at every moment, be in recognizable formation. In performing this last evolution, it is in no order at all, from first to last: with a well-drilled squadron, this may occasionally be permitted, though as seldom as possible; with the greater numbers of a fleet, it might lead to fatal confusion.

The line abreast, in *closed order*, can wheel on either pivot, as before; the radii are smaller, being 300, 400,

and 500 yards, and the speed must be regulated accordingly; $4\frac{1}{2}$, 6, and $7\frac{1}{2}$ knots, on the circle, would probably be found convenient and practicable.

X. The squadron is in line abreast; to form "echelon of ships" to starboard, or port, on any given line of bearing.

The squadron forms into closed order;

(Fig. 12.) The squadron wheels into given line of bearing;

All together, each ship circles through 4 points, thus coming into echelon;

understanding by the term "echelon of ships," oblique line in closed order.

The French word *peloton* primarily signifies "a ball of thread," and has long been used in a military sense, as denoting a small body or knot of men. As a naval term, its strict meaning has never been defined, and has been understood generally as a cluster of 3 or 4 ships, grouped together in any accidental arrangement, as most convenient at the time. What the best arrangement may be has been much discussed; the preference of some resting with the isosceles triangle, vertex ahead, for three ships; and frequently with a fourth ship, astern of all, in the wake of the vertex or leading ship, thus forming a rhombus or square; often also, with this fourth ship on the exterior quarter of one of the ships on the base of the triangle.

It was, I believe, Sir Thomas Symonds who, when

FIG. 12.

Squadron Evolutions X.

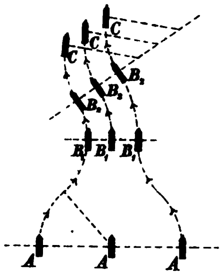


FIG. 13.

A. Squadron in Peloton.
B. Peloton wheels through Six points to Starboard.

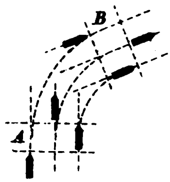


FIG. 14.

"Carré naval."

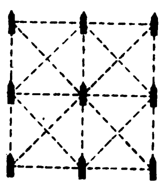
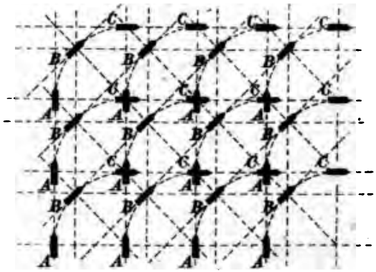


FIG. 15.

Fleet in Line abreast of Squadrons in Line ahead A:
All together, each ship circles through eight points; brings
Fleet in Line ahead of Squadrons in Line abreast; C:
or circling through four points, brings
Fleet in a triple oblique line, Squadrons in oblique line B:



Robt J. Cook & Hammond Lith. 29 Charing Cross

in command of the Channel Fleet, first suggested, as an improvement on the isosceles triangle, in which the two ships on the base mutually mask each other's broadside fire, the arrangement in scalene triangle, the vertex still ahead. In this formation, each ship has her broadside, bow, and stern fire fully open, and the offensive or defensive power of the group is very great; to it, therefore, I propose to limit the use of the word "peloton." The formation, shown in figure 13, is this: each ship's bow is well clear of the stern of the ship ahead; each of the following ships is a length, 100 yards, to starboard, or port, of the leading ship; but so long as the clearance of the broadside, bow, and stern fire is effectively maintained, the order may be as close as the Admiral of the peloton considers advisable.

XI. The squadron is in line abreast; to form peloton, head in any given direction.

The squadron forms *closed order*;

The squadron wheels into given line of bearing;

The starboard, or port, ship, as indicated, maintains her speed; the others, at an increased speed, draw clear; the outside ship reducing her speed as her stern clears the bows of the third; the centre ship reducing in turn, when her stern clears the bows of the second.

This brings the ships into the position shown in figure 13.

The question naturally arises as to the peculiar advantages of the peloton formation; and a reference to the figure permits us to dwell on them in detail. The three ships, in the closest possible order, bring on any point, in any direction, the concentrated fire of the three; no enemy's ship can approach the peloton without receiving this concentrated fire; any ship attempting to ram ought to be sunk by this fire, or if she escapes, must herself be rammed by the rearmost ship of the peloton, if, that is to say, the peloton is formed with its open side towards the enemy; and its effect as a ram, driven against the enemy's line, should opportunity offer, must be irresistible; difficult to avoid, impossible to withstand;—it must either pass through or crush. The line abreast, in closed order, has some of these advantages; the echelon of ships has more; but it seems beyond a doubt that three ships in peloton are, either for offence or defence, in the strongest possible formation.

The closeness which I advocate may be considered internally dangerous. Let, then, the squadrons carefully exercise in it. The closed order will become perfectly safe in the course of practice, and as the ships of the squadron learn to trust in and depend on each other. Thus the peloton should learn to advance as one; to wheel as one; each ship, with known helm

angles, and at exact rates of speed, describing her appropriate circle, which, at the distances I have given, will have a radius of 300, 400, or 500 yards; but which, in a possibly still closer order, may be still less —or which, under exceptional circumstances, if the peloton, consisting of peculiarly handy ships, has to act independently or in a critical position, may be reduced to a minimum. A peloton may very well practise, apart from the fleet, evolutions on much smaller circles than can be adopted by the fleet at large; so as to be able, on emergency, to avail itself of any exceptional handiness. If we can once thoroughly accept the idea that a fleet consists of a number of squadrons, not simply of a number of ships; and that these squadrons, in closed order or in peloton, have their force enormously multiplied, we shall not be far from the conviction that no amount of labour is excessive which is spent in increasing the handiness and closeness of the formation.

CHAPTER IV.

EVOLUTIONS, AS DISTINCT FROM TACTICS.

I propose, then, to consider a fleet as an assemblage of squadrons rather than of ships; and to discuss fleet evolutions as performed on this basis. The squadron thus becomes our tactical unit; and its special formations, the elements on which the evolutions of the fleet must depend.

The first idea of some such division has been, of late years, very commonly attributed to Count Bouet-Willaumez, who may certainly be credited with having brought the arrangement by groups into official notice in his own service; but the English idea of it is of much older date; and though the records of early days are strangely confused, and the accounts of unscrupulous plundering are often only interrupted by references to the piety of the plunderers; thus constantly tending to lead a casual reader to the belief that our ships, 300 years ago, were manned and officered by hypocritical ruffians, rather than by the earnest, zealous men who founded our naval strength; notwithstanding this confusion, the fact still comes prominently forward,

that in the fights with the Spanish Armada, the formation by groups was effectively carried out, and was, indeed, the only attempt at formation at all. I would not, of course, imply that there was any such careful division as I am here proposing; or that the division was then more than the almost accidental determination of tried friends and comrades to stand by each other; but the origin of the peloton, rude in its beginnings, like many other finished conceptions, is to be sought in those battles off the coast of Dorset and the Wight, where the power of Spain was so rudely handled. In advocating its distinct adoption into our service as the basis of the order of battle, I am starting no novelty, but am maintaining the advantages of a system under which we destroyed the Armada, and 70 years later, beat back the more sturdy fleets of Holland. History and our old glories support me in urging the importance of such a basis; and now, with appliances improved in every respect, it is impossible to doubt that the method of concentration which our forefathers found profitable may be rendered most formidable as a means of attack, most hopeful as a means of defence.

I am convinced that in any case, and whatever may be the constitution of the fleet, such a method of manœuvring will be more exact, more precise, and more safe: admitting, therefore, a closer order and a greater speed; for it is quite evident that *three* ships

will, with care and practice, learn to work together in an efficient and uniform manner; whilst it would be difficult, and almost impossible, to get a fleet of 10 or 20 ships to manœuvre together with anything like the same precision or accuracy. But if this is the case on general principles, much more is it so in our own service, whose ships now are, and have been for the last ten years, more or less experimental, differing very widely one from the other; so that with many good qualities as to speed, armour or armament, their capabilities of turning, and therefore of manœuvring, are so different, that it would be a most serious waste of power to insist on all evolutions being performed, or rather attempted, by the fleet as one.

The ship of the future is an unknown thing; we cannot even guess at what the ideal fighting ship of ten years hence may be; the *Sultan,* the *Devastation,* or the Russian *Novgorod,* have, at present, their respective admirers. Within ten years, conceptions still more remarkable than even this last may have been embodied; but we may at any rate trust that ships such as the *Warrior* or the *Minotaur,* the *Prince Consort* or *Caledonia,* will have disappeared from our fleets. So far as we can speak from the facts before us, the *Sultan,* the *Vanguard,* and the *Devastation* will continue to have their representatives, and to form the main strength of our Navy. We have to deal here with reasonable probability; and whilst I believe that

the ships I have named will be typical in their several classes for some time to come, we have actually a number of them ready, or getting ready, sufficient to form a fleet worthy of a great power. Leaving the special and exceptional capabilities afforded by "twin screws" out of the question, none of these seems able to depend on turning in less than 600 yards, although smaller diameters have been obtained at the official trials; and it should be noticed that, for some reason, the circles described on the official trials are almost invariably smaller than those described in the course of active service. It is for this reason that I have assumed 300 yards as the radius of our evolutionary circle, and as our evolutionary unit of distance.

Fleet order of sailing must necessarily often depend on considerations void of all tactical import: these are quite foreign to our present question; and so far as relates to it, the order of sailing must be such that the fleet can, in the same order, act either on the offensive or defensive, or can readily be altered to some other formation more distinctly suited to the emergencies of battle. The order of sailing in line ahead, or in line abreast, cannot therefore be considered tactically sound; for from either of these it is impossible to concentrate the fleet without great loss of time, and the delay might afford the enemy a fatal opportunity to throw his whole force on some one part of the extended line.

It has very commonly been urged that the line ahead is subject not only to this disadvantage, but also to the still greater drawback of being liable to be attacked on the broadside, to be rammed and broken; the attack suggested against it being made in line abreast, in comparatively close order. In respect to this, many inferences have been drawn from the confused fight off Lissa, where the Austrians, in line abreast, charged the Italians, in line ahead; but the commentators have omitted to dwell on the fact that though Admiral Tegethoff's last signal, as the lines were closing, was—"Rush against the enemy, and sink him,"—not one ship of the Austrian line succeeded in even touching one of the Italian. The Austrians passed fairly through the Italian line without causing or receiving any damage whatever; though it must be evident that in passing through, some, at least, of their ships must have been, themselves, in a very dangerous position. From a free fight, such as, after this passage, Lissa became,—where all was in confusion,—where the obscurity caused by the smoke was so great that, all pretence of order being lost, nothing could be made out,—where the maxim Tegethoff acted on was simply "Go at everything grey"; not very unlike the old Donnybrook maxim "Wherever you see a head, hit it;"—little is to be learned in the way of tactical evolution; though important lessons may be derived as to the moral conduct of a fleet, and the value of that practical

yet delicate essence of tactics, which, apart from all technical skill or theoretical considerations, must originate with, must emanate from the Commander-in-Chief. There can be no doubt that with very inferior ships and guns, and with newly-raised ships' companies, the Austrians won the victory because their Admiral knew how to inspire his officers and men with a certain portion of his own courage and energy; whilst the Italian Admiral imparted to those under his command nothing but fear of responsibility and timid vacillation. The *Affondatore* is said to have had several distinct opportunities of ramming the *Kaiser,* and to have refrained from doing so out of misplaced compassion for the weakness of the enemy. No such feeling held back the *Ferdinand Max*; going at everything grey, she charged three or four Italian ships before she finally succeeded in sinking the *Rè d'Italia.* The battle was gallantly fought out by the Austrians, but must be recorded as a victory won rather by personal gallantry and dash than by any superiority of tactics or evolutionary skill.

None the less, the formation in line ahead seems to me radically faulty; but so also does the formation in line abreast; and principally, as I have already said, because each affords the enemy an opportunity of acting against part, only, of the fleet, and requires a long time to change into any compact order. I think, therefore, that neither the one, nor the other can be

recognized as tactical formations, or as having any connection with tactical evolutions.

Here I would pause to define exactly what I mean by tactical evolutions, or formations; for the details of the formations or the evolutions of a fleet, although most closely connected with the execution of any system of tactics, are essentially distinct from tactics; and the conjunction of the names may appear inconsistent and erroneous.

By tactics, I mean distinctively the method of attack or defence, and the direction, in the presence or immediate neighbourhood of the enemy, of evolutions on which such attack or defence depends; and do *not* mean the mere performance of evolutions, whether in presence of the enemy, or otherwise.

It may, however, be freely admitted, that without much preliminary exercise, it is impossible to acquire that skill and precision in manœuvring which may probably enough be necessary for the conduct and safety of the fleet on the day of battle. It has often been suggested that rehearsals may be made with gun-boats, or even with steam cutters; and much valuable experience may, doubtless, be so gained; but the circles of cutters or gun-boats are so different from those of ships, such as (say) the *Hercules* or *Agincourt,* that the aspect of affairs is totally changed; above all, the nervous system of every one, captain, lieutenant, or quarter-master, requires exercise; and the effect pro-

duced on the nerves by the near approach of a small boat, which can possibly be boomed off with a boat-hook, is widely different from that which would be caused by the close proximity of a ship of six or eight or ten thousand tons displacement, capable of striking a blow of 50,000 foot-tons, or more. It is familiarity with such dangers, which inaccuracy, ignorance, or nervousness may easily render terribly real; familiarity with evolutions actually performed with the unhesitating rapidity which would be necessary in action, that can alone give confidence and precision. The crisis of a battle, when the nervous system is excited to an unusual degree, is not the time when a delicate manœuvre, requiring a steady eye and a cool judgement, should have to be performed for the first time.

Insisting, therefore, on the absolute necessity of much and real exercise of the fleet as a fleet, as indispensable to its organisation, I would call those evolutions which are likely to be required, those formations which are likely to be adopted, in presence of the enemy, "tactical evolutions," "tactical formations," in contra-distinction to many others, which, as serving principally to cultivate a precision and accuracy of manœuvring, may perhaps more properly be called "evolutions or formations of exercise."

It is, however, only with the first-mentioned of these that we are concerned, and with them only in a secondary degree. Our purpose is the scientific in-

vestigation of tactics and the general principles of tactics, as adapted to the present state of our own and foreign navies; not the minute and technical detail of evolutions; so that I enter on the discussion of some few of those formations and evolutions, which may, in all strictness, be designated "tactical," with the view of illustrating the tactical principles I lay down, rather than with any intention of supplementing the signal book, still less, of endeavouring to exhaust the subject.

Professional opinion is everywhere with me in refusing to admit the line ahead as a tactical formation; and though the line abreast has still many supporters, it, also, is now very generally considered too weak and extended. Modifications of both of these have, however, been very steadily urged; such as the double line ahead or double line abreast, where the ships of the one line cover the spaces between the ships of the other. This arrangement has been called, after the French, *indented line;* or after the Russian, *chequered line.* I would suggest that, as each line fills up the spaces left by the other, and supplements it, the term *supplementary lines* would more exactly express the force and advantage of the formation, whether applied to lines ahead, or lines abreast; and in this sense I shall use it when occasion requires.

The formation in supplementary lines ahead is, doubtless, free from the excessive defect of the single line; but it is still too extended, and is not always

easily got together. A concentrated attack on the rear might inflict fatal damage on one or two ships, before the van could come round to their assistance; and we know, from the experience of Lissa, how the sudden and total loss of one ship unnerves, demoralizes, the whole fleet. For instance, if the fleet consist of 12 ships, each of the lines contains 5 distances, or 1500 yards: and the time before the leading ships could come round to the close assistance of the rear would be

time of half-circle + time of 1500 yards; that is,

$$\tfrac{1}{2} \text{ of } 9\tfrac{1}{2} + \tfrac{3}{8} \times 15 = 10\tfrac{1}{2} \text{ minutes nearly};$$

or at an extreme speed of 12 knots, $7\frac{1}{4}$ minutes; in either case, time enough for much mischief to be wrought.

Supplementary lines abreast are not subject to this disadvantage to anything like the same extent; and this formation has been commonly put forward as a sound order of sailing and of battle. I will not undertake to say it is absolutely bad; but I do not think it will be difficult to find a better; and would very distinctly prefer the order of sailing which Count Bouet-Willaumez has described, under the name of the "carré naval," or naval square, modified so as to be suitable to any number of squadrons. The French Admiral has limited his square to *nine* ships, arranged as in figure 14; from which it will be seen that, from the symmetry of the formation, if the ships, all together, circle through any number of points, they are

still in square, still in a recognized order of sailing: and has determined that, if the fleet consist of more than nine ships, the excess is to form an advanced guard, or reserve, so as not to interfere with the symmetry of the square.

I cannot, however, admit that this symmetry is so important that the compactness, or what I would wish to call the solidity, of the fleet should be sacrificed to it; and I believe that we should have all the necessary advantages of the proposed square, without any such sacrifice, in the formation in line abreast of squadrons in line ahead; which by each ship, all together, circling through 8 points, becomes line ahead of squadrons in line abreast; or which, by circling in the same way through 4 points, becomes a series of oblique lines, in a most easily kept formation. These changes are better illustrated by diagram, and are shown in figure 15.

I accept then this formation as the best evolutionary order of sailing: it is compact; it offers no point of decided weakness to a sudden attack; and it is easily changed to any other, as circumstances may require; changes which will be executed almost entirely by the squadrons as squadrons, although, necessarily, on the one circle prescribed for all fleet evolutions. Thus, purely as squadron evolutions, the squadrons, as such and independently, form close order abreast, or closed order, or peloton, or echelon; whilst as part of the fleet, collectively, they form column, or line, or echelon, or

FIG. 17.

Fleet in Echelon of Pelotons

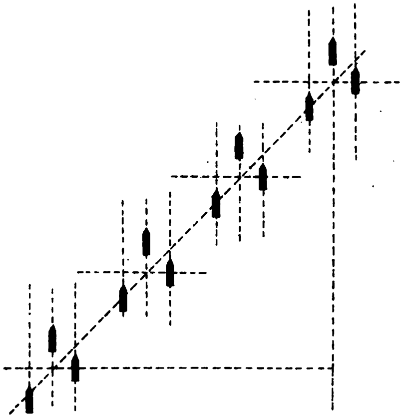
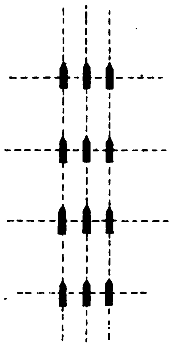


FIG. 16.

Column of Closed Squadrons



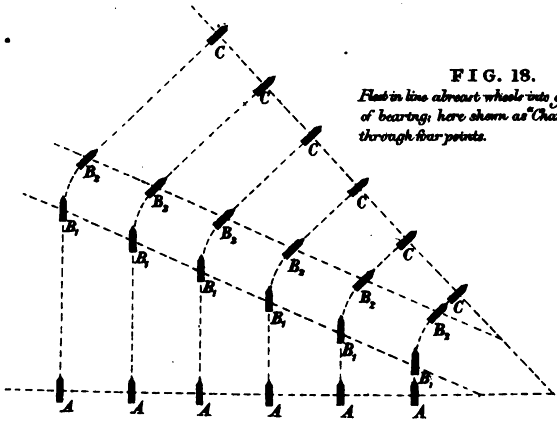


FIG. 18.

Fleet in line abreast wheels into given line of bearing; here shown as "Change of Front" through four points.

triangle of pelotons; as shown in figures 16, 17.

Indeed, almost the only evolution performed by the fleet, in its collective capacity, is the change of front in line abreast. As has been said (page 59), the method of concentric circles, admirably adapted to a squadron, is not suitable for an extended line; and the correct way of wheeling a long line has given rise to much unsatisfactory discussion, leading almost to the conclusion that—the change of front being indicated,—the only available method is to let the ships find their way into position as they best can; and bringing forcibly before our memories Punch's volunteer officer, who got his company in line across a ditch by the order, "The company will disperse, and in five minutes fall in, on the other side." Not being prepared to accept this volunteer method of manœuvring, I believe that the simplest, and easiest, and in most cases, the shortest way, is this:—

> By squadrons, form column; head to starboard, or port, as indicated.
>
> Column changes course to given line of bearing; in a manner similar to the changing course by a squadron in line ahead;
>
> By squadrons, reform line abreast.

And in this, the squadrons may be in any desired formation, closed, peloton, or otherwise; or in open order, forming one continuous line.

The following method, recommended, or adopted in the Russian service, has a mathematical neatness about it, which renders it, at any rate, plausible.

Without changing course, the ships, by change of speed, range themselves obliquely on a line, which makes with their original line of front, an angle equal to half the required change.

(Fig. 18.) When dressed on this line, head in original direction, all together circle through the required number of points, thus heading in the required direction.

Regulating her speed as necessary, each ship advances into her position in line abreast.

I am not, however, altogether prepared to recommend this method; doubting whether the dressing a long line on a line of bearing, at variable distances, and the other changes in the evolution are so simple as to be certainly within the capability of a fleet in such order as we may reasonably expect. In the triple line which I have spoken of, it would not, however, be so complex as it may here seem; and, to change front, in that formation, the preference between the two methods I have detailed becomes a mere question of angle; if the angle is large, the former method is undoubtedly the best; if small, the latter may be better.

In prescribing fleet evolutions suitable for the present state of the navy, and for the probable circumstances of future war, it must not be lost sight of that fleets numerically large, are not to be expected. It is scarcely possible that for any purpose of war, fleets of 30 or 40 ships of the line, such as were common in the last century, will ever again be got together; a fleet of 12 ships will probably be considered large, and I am here inclined to fix that as my limit. But the formation by squadrons, which I have recommended, is not necessarily limited to that number, if circumstances of policy or strategy render it advisable to exceed it. It must, however, be noted that, as the fleet gains in size, and, so to speak, in "brute strength," it loses in compactness and handiness; it becomes difficult to manœuvre it as one body, or to hurl it on the enemy in one concentrated mass. It is, therefore, an important question what absolute limit should be placed on the formation I have suggested; and my opinion would be that with more than *five* squadrons, the fleet, collectively, would lose in evolutionary power. With more than that number, I would divide them into two distinct parts, each formed on the same basis; manœuvring in concert with each other, but not together; with such interval between them as the Commander-in-Chief shall see fit to prescribe, and able, at his pleasure, to threaten or act against the same or different portions of the enemy's fleet.

In this, as in any other consideration of tactical problems, the main objects must be clearly borne in mind: these are, primarily, so to form the fleet that it may not offer any isolated portion to the enemy's attack, and that the whole fleet may readily be brought into action to repel attack; secondly, so to manœuvre as to be able to throw the whole, or an overwhelming portion of the fleet on some small part of the enemy's; and, out of his whole array, to select that small part which by some inadvertence, mistake, or want of skill, has been placed in such a position that assistance cannot readily be given to it. In this it is not our object merely to bring a certain preponderance against a large body of the enemy capable of maintaining itself for some time; but to bring a force so enormously superior against a small body, that that small body must be crushed at once. I do not, for instance, conceive that throwing six ships on four, although a favourable condition of combat, is the highest end we can aim at. Four good ships may possibly enough be able to hold their own against six, until assistance arrives; and the neglect must be great indeed which, with equal numbers, keeps it back more than 10 minutes. But if we can drive the whole fleet, at a high rate of speed, an avalanche of pelotons, on two ships,—those two ships must be destroyed; and the enemy's fleet, altogether demoralized, may be dealt with at pleasure.

It is distinctly with these objects, which, whether for defence or attack, are theoretically sound, and have practically both limits and opportunities, since they bear on the very uncertain bases of mans' brains, and nerve, and judgement, and courage, and discipline, and skill, that I urge the extreme closeness, compactness, and solidity of formation, which I have advocated. Manœuvring by squadron seems to me the most direct way of attaining the required closeness, and of using it when attained; but the detail of this, and of the various possible formations into which the fleet may be thrown, is scarcely within the purpose of this essay. What I have said is sufficient to convey a general idea of the manner in which, I think, all evolutionary problems, from the simplest to the most complex, can be worked out; when, only, it is definitely and officially ordered that they are to be worked out.

When this has been done; when evolutionary squadrons and fleets of gunboats or steam cutters are exercised systematically and regularly; when an evolutionary fleet of iron-clads is got together each summer, and worked as such for a month or six weeks, regardless of petty economy of coal and stores, unworthy of a great nation, and of a service with ten thousand glorious traditions to maintain; when it is understood that the summer gathering of our ships is for severe drill, and the practice of evolutions;

not merely as an occasion for joyous festivities, for the establishment of a raree-show, and the entertainment of our gaping countrymen in the several towns along our coasts; then, the practical and professional study of tactics will have been really begun; then, we may hope that much that now seems hopelessly dark as to the tactics of the future, will shine out, illumined by the lamp of knowledge.

CHAPTER V.

TACTICS, AS DISTINCT FROM STRATEGY.

IN laying his plans for an approaching battle, in considering the tactics which, under various circumstances, he may best adopt, it is especially necessary for the Commander-in-Chief to know that the fleet can readily perform the evolutions he may prescribe; and without this knowledge it is impossible for him to feel confident that his signals will be obeyed with that precision and quickness which are imperatively called for. The requisite practice of fleet evolutions has thus come to be very generally called "Naval Tactics"; a use of the word which is not strictly correct, and is so far unfortunate, that it deprives us of the word which alone expresses its true meaning. Feeling this want, some writers have attempted to introduce "strategy" in the sense of "tactics": an attempt which, however, has met with very slender success. Strategy has a well defined, clearly understood meaning of its own; and refers directly, not to the conduct of a battle, but of a campaign; and orders, not the performance of

certain evolutions, but the locality in which the fleet is to cruize, and the object which it is to have specially in view: such as the blockade of a port; or the raising of a blockade; the luring the enemy to a distance so as to allow store ships or transports to pass safely; or simply the meeting with and engaging the enemy, and the destruction of his fleet and stores. The detailed plans for the execution of these objects come under the head of Tactics; whilst the actual carrying out of these plans is manœuvring, is performing evolutions, accompanied or followed by actual combat.

In the foregoing pages, I have discussed at some length the methods of manœuvring, and of executing the different formations likely to be called for in presence of the enemy. When we have to consider the manner in which a fleet is to be brought into action, and manœuvred whilst in action, we are compelled to suppose that the fleet is capable of performing these and other necessary tactical evolutions with sufficient precision, and with a closeness and quickness dangerous only to the enemy. I have already dwelt on the imperfection of results obtained from the theoretical study of tactics, in consequence of the assumed perfection and the real imperfection of our data. Theoretically, an evolution is laid down on paper; the circles, the distances, and the times calculated; and the fleet, the squadrons, and the ships are in exact position, in exact time. Practically, the result of the evolution is not so

exact; neither position nor time can be strictly accurate; that they may be approximately so, is the most we can hope, under favourable circumstances. On considerations so variable and so vague, we cannot enter here; but this possible and probable inaccuracy must form an important part in the basis of the calculations of the Commander-in-Chief, and exert its due influence on the tactics he adopts and the evolutions he orders.

When two hostile fleets approach each other, the immediate result of their proximity, and the tactics acted upon, must depend on the strategy by which the Admirals commanding are ruled. If, for instance, a port or line of coast is blockaded, it may be the strategy of the fleet which covers the blockade, to run no risk of its being broken; not to allow itself to be enticed to a distance; to present a bold front if an attack appears to be intended; to fight if necessary; but to consider the strictness of the blockade the first object of its presence in the given locality. On the other hand, the fleet which is endeavouring to relieve the port may be, numerically or otherwise, of a strength insufficient to do so, by at once engaging; it may, therefore, endeavour to lure away the enemy, so as to admit of the blockade being broken; it may endeavour to manœuvre, so as itself to break the blockade; or to cut off any reinforcements or detachments of the covering fleet;—in fact, the reasons are almost countless which may

lead one side or the other to avoid a decisive action, and the consequent crippling of many ships.

De Suffren's relief of Cuddalore, in 1783, is a direct illustration of the carrying out such a strategical system. No Admiral in command of a fleet has ever exhibited greater readiness to fight than De Suffren, when it was in accordance with his policy or strategy to fight; but, a master of tactics far in advance of his age, he was equally ready to avoid action, when so doing better suited his purpose; and thus, at Cuddalore, on the 17th June, 1783, after manœuvring for the whole day, in opposition to the English fleet under Sir Edward Hughes—never attacking, but compelling him to keep constantly prepared for attack—he succeeded, towards evening, in interposing the whole of his fleet between the English and the shore, and opening communication with the blockaded town. He was thus able to land all his sick, of whom he had on board a very large number, and temporarily to replace them with soldiers lent from the garrison; on the strength of which reinforcement, he went out the next day, determined, if possible, to prevent the renewal of the blockade which he had so skilfully broken. The indecisive action which followed, after two days of manœuvring, would probably, by the mere injury inflicted on the spars and rigging of the English ships, have effected his purpose; but the news of peace, which arrived almost while the battle was raging, rendered it nugatory. With that

treaty, we have, of course, no concern here; but the operations of the 17th June remain, a most conclusive evidence of the manner in which a fleet, not superior to the blockading one, may break the blockade, and accomplish its object more certainly, without fighting, than by an engagement, which, between forces nearly equal, must be necessarily doubtful. On the other hand, the notorious failure of Admiral Byng to relieve Minorca, in 1756, shows how the covering fleet, whilst avoiding decisive action, may yet be distinctly successful, even against a superior force.

It has become so much our habit to speak of the meeting of two hostile fleets as involving immediate action, that it is necessary to point out that such is not the case, and that instances are frequent in naval history, in which no action, or at least no decisive action has taken place, simply because it has been the strategy of one or the other Admiral not to fight. There are of course other circumstances in war, which may bring about the meeting of fleets, besides the attempt to relieve or enforce a naval blockade; but on critical examination, they will be found to have many points of resemblance, or even of exact similarity; and very few battles of any note have been fought which may not be placed in some such category. Most of them, indeed, have referred directly to a blockade of some sort; Matthews' action off Toulon, Byng's off Minorca, Keppel's off Ushant; the battle

of the First of June, St. Vincent, Camperdown, Nile, Trafalgar, were all fought as enforcing a blockade; Sir George Byng's action on the east coast of Sicily, Boscawen's in the Straits, Copenhagen, were, strictly speaking, also so fought; the action between Anson and La Jonquière was for the attack and defence of convoy; so was Hawke's with l'Etenduère; whilst his more celebrated engagement in Quiberon Bay was the result of Conflans's attempt to raise the blockade, which the English had been maintaining on Brest and the west coast of France.

It would be easy to multiply instances of this to a very great extent; but I have adduced enough in support of the statement I have made, that almost all naval battles have been fought in the endeavour to enforce or relieve a blockade; the attack or defence of convoy; the covering the landing or retreat of troops; or under circumstances closely analogous, and which have rendered it practically impossible for both Admirals to have the same disposition for immediate and decisive battle. It is thus almost certain that when two fleets approach each other, one, at least, will not attack; very probably the other will, and since it will now be comparatively difficult to avoid action, in the open sea, with a determined enemy, we may lay it down as an approximate axiom, that of the two fleets, the tactics of the one will, in the first instance, be offensive; those of the other defensive.

Neglecting these considerations, a future naval battle has been often described as a clashing of the two fleets, advancing against each other, in line abreast, at a speed of about 8 knots; a passing through each other, with little serious damage; and a return on each other, in such formation as the more or less crippled state of the ships may permit. As I have just said, I consider such a battle almost an impossibility; I can find no parallel to such a mutual attack in the whole history of modern naval war; unless indeed, we except Lepanto, which, notwithstanding its date, belongs rather, in all its distinguishing features, to the middle ages; but in addition, the line abreast is such a weak tactical formation for either attack or defence, that I can scarcely conceive the existence of two opposing Commanders-in-Chief, who would place confidence in it.

But supposing that one fleet, or the other, prepares to engage in such a line; the attack, or defence, it matters not which, has but to form in echelon of pelotons, threatening the whole enemy's front for a time, and so fall obliquely on either wing, according to choice; the extreme ships of that wing must be annihilated before assistance can be brought—before the ships from the further end of the line can get near the scene of destruction.

The echelon of pelotons, as shown in Figure 17, is obviously a very strong defensive formation; a

series of batteries, bringing a most dangerous cross-fire on ships approaching them: for attack, the column of pelotons may perhaps be preferable; but the oblique attack that I have just spoken of is simply the successive conversion of the "echelon" into "column" on the oblique line, so as to break into and through the enemy's line at an angle of 4 points, or thereabouts. I can see no probable issue but utter ruin to either attack or defence in line abreast, if operated against in this manner.

None the less, it must always be borne in mind that the attack has many inherent advantages over the defence; to uneducated men it is far more inspiriting, and braces them to an eager confidence in themselves and in their officers; but the actual and physical advantages are almost greater: it can choose its own time and method; it can watch for an unwary moment; for a careless or ill-judged movement; it can annoy by feints and alarms; by a thousand artifices, it can veil its intentions until the suitable opportunity arrives; above all, it may come out of a fog, or out of the grey of the morning, and finding the defence unprepared, with fires, perhaps, banked, may close before it has time to repair its mistake.

I have already expressed such a decided preference for the order of sailing by squadrons (Figure 15) whether in line ahead, line abreast, or line oblique, that it is unnecessary now further to dwell on it; but

it is merely as an order of sailing, that I commend it; though compact, it wants the closeness and solidity which seem to me essential in a true order of battle. Bnt from this order of sailing, the formations in closed squadrons or pelotons are easy; and I would again urge my conviction that formations by pelotons, in echelon, in column, or in supplementary lines ahead or abreast, according to circumstances, are the orders of battle which a well exercised fleet will find most advantageous.

All other formations I put on one side as objectionable, as wanting in solidity, as liable to be broken and worried in detail. The first burst of the battle should fall as a heavy and continuous blow on the enemy's weakest point. Not merely to defeat, but to *annihilate* that part of the enemy's fleet, is the first object; the capture, or destruction, or flight, of the unnerved remainder must follow, almost as a necessary consequence.

From this view, a naval battle, in future, will be of extremely short duration. Ten minutes of actual combat must virtually decide it; and the decision must, theoretically, be in favour of the fleet which, at the critical moment, can manœuvre in the most solid formation and at the greatest speed. It has constantly been put forward that the advance of ships will be at moderate speed, but that their evolutions in action will probably be at very slow speed. From this view, I

emphatically dissent. The advance may indeed be at moderate speed, quicker or slower, according to the temperament, the strategy, or the tactics of the two Admirals; but one or both will probably quicken as the crash approaches; at such a moment, the regularity of the formation is of more consequence than any variation in speed; but afterwards, when the exactness of the formation has given way in the actual or impending crash, I believe that critical evolutions of a simple nature, will be performed by the squadrons at the highest possible rate of speed; and that on the capability of the squadrons to bring a high speed into effective play, the issue may often depend; other things being equal, pelotons which can charge in concert at a speed of 12 knots, must crush those which are limited to 10 knots, and will do so with still greater certainty if they can increase their speed to 14 knots. There is here no question of liability to collision. If ships and squadrons are in good order, and know each other, they ought to be able to perform all simple evolutions at any required possible rate of speed, without fouling each other; as to fouling the enemy, the sooner they can do it in a proper manner, stem on, the better.

But this ability does not come by mere light of nature. Much pains-taking exercise is necessary before it can be attained. We have been told that genius is nothing but the capability of taking pains—a most exaggerated statement, constantly misapplied; none

the less, we may accept it, with an important modification: genius is nothing *without* the capability of taking pains. In this lies the secret of all success, in the arts of war, as in the arts of peace. All history teaches us this; and more than any other, the history of our own Navy. Whilst we feel justly proud of the achievements of the heroes of by-gone ages, let us remember that they passed through a long course of patient and arduous service, before their career culminated in high command, victory, and fame. From the days of Drake or Hawkins, to the days of Nelson or Collingwood, we find biography telling the same story in different words. Not to mere heaven-born inspirations are the glories of the past to be attributed, but to the zeal, energy, and experience of men who had devoted their lives to their noble calling.

Much has changed in the present time; few things more so than the outer symbols of seafaring life. Ships, guns, machinery, are new; the hearts of men and their inner powers are still the same. Fatuity and ignorance have, before now, placed us on the verge of defeat, and may, at any future time, carry us beyond it. Experience and skill have often led us to victory, and may again lead us—the guardians of our dear native isle—triumphant before an admiring world. Since the days of Hercules, the adage, quoted in many languages, has lost none of its force—

AIDE-TOI, ET DIEU T'AIDERA.

III.

Essay on Steam Tactics

IN A GENERAL ACTION.

BY

LIEUT. CHARLES CAMPBELL, R.N.

"Que la guerre n'est autre chose que l'art de reunir plus de monde que l'ennemi sur un point donné."

INTRODUCTION.

I HAVE written this paper under the strong conviction that the 'group' formation of three or four ships acting as one, will in the future prove the most effective in a general action at sea; at the same time leaving it to the Commander-in-Chief of the fleet engaged to determine whether he shall use this, or the present system of the 'single ship' unit. I believe that no formation is better adapted for the development of the Torpedo, the Ram, and the heavy Artillery of the present and future.

It is short, as my time has been limited; but, nevertheless, I hope I have clearly expressed my views, and that what experience I have had may go in a small way to add to the light already thrown on this very important part of naval warfare, and to benefit that Service in which we are all so proud to serve.

CONTENTS.

STEAM TACTICS IN A GENERAL ACTION.

CHAPTER I.

ON THE COAL NECESSARY FOR STEAM TACTICS IN ACTION.

So much has already been written and said on the subject of coal for the Navy, that I will confine myself to that feature in its decomposition which is most important for steam tactics.

Coal, for the purpose of fighting an action between two large fleets at sea, must be smokeless. No one who was present during the manœuvres of the Combined Squadron of 1871 can doubt the absolute necessity of this important point for one moment.

Clouds of dense black smoke shut out the ships from each other's view, and entirely prevented the Commander-in-Chief's signals from being seen and understood by many ships of the fleet. That the entire prevention of smoke is at this moment unattained is a fact to be looked upon with deep regret, and no amount of trouble or expense can be too great that will provide for the moment of war an abundant supply of smokeless fuel; especially for the use of a fleet that may be likely to meet with an enemy sufficiently powerful to cope with it in a general action at sea.

I look upon the system of communication between the Admiral and his fleet as vitally important to the success of an action in the present time and in future, even more than it was in days gone by; as may be seen by any one taking part in the Channel Fleet Manœuvres each time they go to sea. It is at times literally impossible to make out the Admiral's signals, and this is still more palpable when top-gallant masts are down and the ship is clear for action. Pure Welsh coal is very good up to a certain speed, but I have never seen fires forced or ships at full speed without dense volumes of smoke issuing from every funnel in the fleet, blacks and cinders flying about and injuring eyes that are supposed to be intently watching the Admiral's signals and movements, and the signals themselves obscured, not only by the smoke of the vessel that is making them, but also by the smoke of the vessels to which they are addressed.

The present plan of admitting air at the back of the furnaces in small jets through a plate perforated with small holes for the purpose, and regulated from the stoke-hole, will increase heat and diminish the number of chemical particles which otherwise would pass into the atmosphere up the funnel; at the same time no one could say that it has rendered smokeless the mixture of North Country and Welsh coal for which it was made. Let us recognise the fact that we have at present no apparatus or fuel that will generate

steam in our boilers without smoke. I am of opinion that a supply of coke sufficient to take a ship into action should be carried by each ship—to be used for that purpose alone. It should only be supplied in war time when there was a chance of a general action at sea.

If from want of stowage power, or capability of carrying the quantity required for this purpose, it were thought unadvisable to supply coke, then, unquestionably, the only coal that should be supplied is the pure Welsh. I have heard it suggested, that in case of the fleet approaching an enemy, the ships having the wind aft, and consequently driving before them and obscuring their movements from the enemy, would have an advantage over the ships having the wind ahead. As far as my experience teaches me, this is not the case, for I have always found it is as hard, or harder, to see through smoke driving before you as it is to see through it coming towards you. And I believe the ships coming up against the wind would be the first to see what formation the others were in.

CHAPTER II.

ON THE SIGNAL BOOKS AS RELATING TO STEAM TACTICS.

In all evolutions performed by a fleet at sea in the presence of an enemy, the one important point is that they should be quickly understood by the Captains commanding the ships composing that fleet. To attain this very desirable result it is necessary:—

First—That the signals should be as few as possible in number.

Secondly—That the explanation attached to each signal should be as explicit and concise as possible.

Thirdly—That the officers of Her Majesty's Navy should be instructed in the manner of performing the manœuvres as early in their career as possible.

Changes in naval warfare are constantly rendering changes in ships necessary. Changes in ships bring about changes in manœuvres, and also in the manner of performing manœuvres, and these changes necessitate alterations in the signal book. The present signal book—good as it is, and suitable as it is to the wants of the Service in many ways—would be none the worse for a new edition; and the signals relating to evolutions with a fleet should be entirely revised.

I would suggest that the rules for the guidance of

a fleet 'During Evolutions,' 'Conduct of a fleet,' 'Changing Formations,' 'Fleet organization,' etc., etc., should be re-written and massed together, and an index printed and placed just before the part of the General Signal Book containing them. As the rules alluded to are printed at present, it is most difficult for anyone not thoroughly conversant with the signal book to call attention to any particular rule required at a moment's notice. Some of the rules in different parts of the book are confusing, especially to those who, perhaps, serve for the first time with a squadron. Take, for instance, '*Close order, when to be kept.*'

Art. 2, General Instructions, page 55, states:—"When a signal is made for the fleet to form in "any order, each flag officer and Captain is to get into "his station as expeditiously as possible, and to keep "in *close order* if not otherwise directed."

Art. 4, page 71, states:—"Close or open order is to "be maintained throughout all evolutions, according to "whether the fleet be in *close or open order* when "the signal is made, unless contrary directions are "given."

Art. 3, page 77:—"Close order is always to be "understood in signals for forming orders, unless con-"trary directions are given."

Now, though these may read easily enough when written down under one another, with plenty of time to think over their meaning, yet take them in an

evolution—in the hurry of the moment—stumbling from one page to another—and you will seldom find a new hand at it without an argument on the subject. Anyone unacquainted with the rules of the signal book, and wishing to find authority for acting on any point of which he himself may be doubtful, may have to read through the whole of the instructions before he finds what he is in search of.

I would therefore propose, as a means to simplify evolutions and the manner of performing them, that the whole should be massed under one head, namely:—'General Instructions'; carefully compiled, and preceded by an index for reference. Should it be thought better to keep them under separate headings, there should be an index all the same, and the different headings be placed in the book as near to one another as possible.

Having made out and placed our rules, we now come to the Evolutionary Signals, which of course, as regards tactical formations, form by far the most important part of the book.

The only way, it appears to me, to effect a thorough and necessary reform of these signals, is to erase, as it were, every signal now in existence, and form the evolutionary table afresh; commencing from the very beginning to work upon what must now be apparent to all who are well acquainted with the practical working of evolutions under steam, and that

is, "The time for working entirely with a single ship, as a unit, has passed, and *tria juncta in uno* must now be the order of the day." Consequently, the new evolutionary table should be formed in such a manner that it shall always be optional with the Commander-in-Chief of the fleet whether his signals shall be obeyed by single ships as the unit, or by the group of three acting as one ship and moving in the changes of formation as one ship.

This object was admirably grafted into the signal books in the Channel Fleet during the winter of 1871-72, by inserting the signals to form groups and to work in that formation until the order should be countermanded. This was found to work perfectly then, and is now worked with equal success in the present Flying Squadron. I will not deal here with the position of the ships in the groups, as I shall come to that in discussing the best method for attack in a general action.

I mention the groups now, as I feel sure that instead of grafting the 'group' formation into the middle of the evolutionary signals, a far better plan would be to re-arrange the tables on the principle of using three ships as the unit.

In adopting this principle we should gain by being able to reduce the number of signals in the table, as groups would entirely take the place of subdivisions. We might at once lay all signals connected with them

on one side, or make a careful selection of any that might prove useful in a very large fleet where you had subdivisions of groups which must contain, at least, six ships in each, (and had therefore much better be termed divisions, even at the risk of having more than four divisions in the fleet.) What could be more simple than to take a numeral flag which at present has no meaning attached to it, and make it the 'Group flag'; changing the meaning of all signals made with or after it to, 'Groups working as single ships,' until it should be annulled by the Commander-in-Chief.

As far as the alteration necessary for this is concerned, it would only be to insert this numeral flag in the blank space opposite. When hoisted singly, ships of the fleet take up the 'group' formation as laid down in the general signal book, and remain and work in that formation as one ship until this signal is annulled.

We now come to the sorting and re-arranging the tables so as best to meet the wants of the fleet of the present and future. First of all, we have the thirteen signals for forming orders when the fleet is either formed in some order or not. The whole of these are admirably adapted for use with the 'group' formation. 'Single column in line ahead,' and 'column of divisions in line ahead' would still be as useful as ever. 'Single column in line abreast' is perhaps not often used,

but is still too useful to be done away with. 'Column of subdivisions in line ahead' might be done away with; but what is more useful for 'groups in echelon' than 'Line on a bearing indicated, on same course as the Admiral'? The five last signals would all be most useful and simple in manœuvring groups.

I have seen attempts made to work the signals on page 79 and 80, just referred to, as rectangular movements, but as there is no authority making them such, I consider that it is only liable to create confusion at present; at the same time I fully believe that a great advantage might be gained by making No. 9 flag (which at present has no meaning attached to it) the rectangular flag, and when it is hoisted at the same time as any evolutionary signal, the movement ordered by that signal to be rectangular.

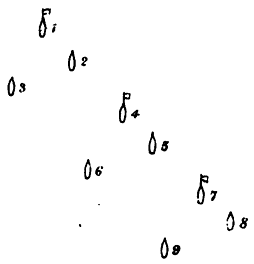
An order existed in the Channel Fleet in 1872 that rectangular movements and forward movements on a pivot ship combined, were to be executed by these signals, and the leader's cone and helm flags were to be carefully watched to see if he turned keeping his speed, or stopped keeping his direction. How much more simple it would be to hoist the 'rectangular-movement flag' with the signal; and how much less the risk to the ships in the fleet. Were this plan adopted I should then say that these few first simple signals might be used for any manœuvre a fleet might wish to perform.

There is no doubt that a fleet changing formation in advancing towards an enemy should change by a rectangular movement, if for no other reason, to preserve the rate of steaming in all ships alike. Therefore it would no doubt be advantageous to use these forming signals in many cases as rectangular movements when advancing towards the enemy; but at the same time it might often be necessary to advance the rear part of the fleet on a pivot ship, and when that is the case, the absence of the 'rectangular-movement flag' would denote that the evolution was to be performed in that manner.

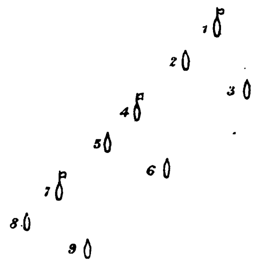
I will now give an example to explain my meaning more clearly. Suppose a fleet of twelve ships, moving towards an enemy in 'columns of divisions in line ahead.' They are in four divisions, with three ships in each division, with their heads towards the enemy, as shewn in Fig. 1.

First, the Commander-in-Chief wishes to change the unit, and the numeral 'Group flag,' hoisted singly, conveys his wish to the fleet. Each division, by a simple helm movement, takes up the 'group' formation by No. (2) in each division forming four points on the starboard quarter of No. (1), and No. (3) seven points abaft the port beam of No. (1), and at the distance laid down. The Commander-in-Chief now wishes to form 'single column of groups' by a rectangular movement: so the 'rectangular-movement flag' is hoisted

Starboard Line of Attack.



Port Line of Attack.



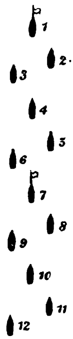


FIG. 3.

Single line ahead in Group Formation.

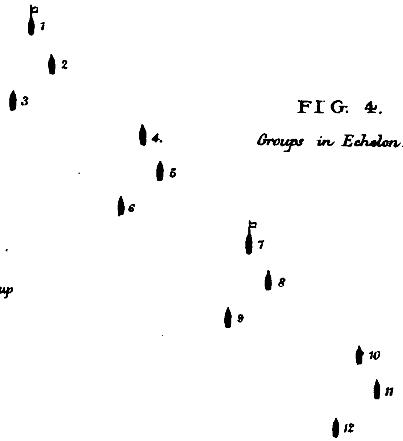


FIG. 4.

Groups in Echelon.

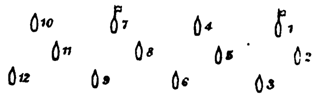


FIG. 2.

Column of divisions in Group Formation.

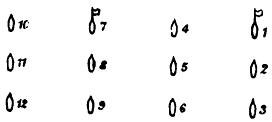


FIG. 1.

Column of divisions with single ship as unit.

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at the main, and *Form single column in line ahead* at the mizen; the starboard group leads on, and the remaining groups, turning together to starboard, form astern of the leading group. The Admiral may now wish the fleet to push up and form groups in echelon on his starboard or port quarter, and *Form line on a bearing from the Admiral,* with a bearing hoisted; places all the groups on any exact position he may choose to appoint, the leading rule being that each ship in each group must be clear of the broadside, stern, and bow fire of all other ships of the fleet. This is shewn to be the case in Fig. 4, and has been arrived at by a rectangular and a forward movement following each other. The first clearly shewn to to be a rectangular movement, by the presence of the 'rectangular-movement flag'; the second clearly shewn not to be so, by its absence.

Should this plan be adopted, it will give to our Navy the use of those few simple formation signals for nearly all purposes, and do away with that uncertainty that ever must attend the watching of steam cones and helm flags, especially when the fleet is at (or over) a speed of eight knots, and a ship or two is between the vessel which has to act and the leader. Not only do we gain the advantage thus described, but, supposing the Admiral had (from a sudden movement of the enemy, or other cause) wished to form groups in echelon on either quarter at once, the

signal, *Form line on a bearing from the Admiral,* with the bearing, would have given the line of bearing the groups were to form upon. The numeral 'Group-flag' would have formed the groups, and the numeral 'rectangular-movement flag' would have made the movement rectangular; so that these three signals, with a bearing, would have brought the fleet from *Columns of divisions in line ahead*—the lines the *port* side of the Admiral—to *groups in line of attack* the *starboard* side of the Admiral, and by simply altering the bearing, would bring them to any other line of attack he thought fit.

I have not attempted to shew here the exact relative positions of the ships in the groups for the best bearing for *line of attack,* etc., as what I wish to shew, at present, is merely the use we could make of those first signals in re-forming the evolutionary table. The meaning of the 'Group-flag' being clearly understood, I would enter them all, putting *Single column in line ahead* on one side for further consideration after the remaining signals had been dealt with; for, in a case like the one stated on page 12, it might have been thought more convenient to organize the twelve ships in two divisions of six ships each. Had this been the case each group would have been a sub-division; and before changing the unit the Admiral might have wished to manœuvre in sub-divisions. My own opinion is that sub-divisions should be done

away with entirely and groups should take their place; but the only objection I see to keeping formations of sub-divisions in the signal book, is the increase in the number of signals it entails. It also interferes with one of the three things we should always keep in mind when adding a single stone to our tactical edifice, namely, *shortness*, *conciseness*, and *clearness*—before everything.

We now come to the second, or illustrated part of the evolutionary table: and here, as before, having taken all the signals out we commence re-entering them. The signals, pages 82, 83, *forming column of divisions in line ahead and abreast from single column in line ahead*, are divisional and rectangular, and are perfectly suitable both for the single ship—as unit—or should they be hoisted after the 'Group flag' has been shewn, will suit equally well for the group formation; they should, therefore, be re-entered. On the two following pages in the table we find four sub-divisional changes, which, should the 'group' formation be established, would be perfectly useless, would never be required, and should be left out.

The two signals, on page 86, *forming column in line abreast from two or more columns in line ahead*, would be most useful. They are divisional and rectangular, and suitable for either 'single ship' unit, or 'group' unit.

The signals, on page 87, *forming column of divi-*

sions from column of sub-divisions, being sub-divisional, and of no use to this system, should be omitted.

The signals on pages 88 and 89, *from divisions to line ahead—turning to port*, and *from divisions to line ahead turning to starboard*, would both be useful and should be re-entered. But on page 90, 91, 92, *form threes, fours*, etc., columns of three's and fours would be entirely superseded by the 'group' system, and, therefore, might be left out. A group might always consist of three, or four, whichever the size of the fleet suited best and the experience of its Commander had taught him to consider the better fighting formation for attack or defence.

The signals, pages 92 to 99, have already been taken out. The 'group' formation, as used in the Channel and Flying Squadron, was put in at page 96; as also the signal for the group to re-form on any particular number in that group. But by using the 'Group flag' we do away with any necessity for using the signals on page 96; only, in re-forming the evolutionary table, proper signals might be picked out to replace them, and a signal would naturally have to be entered for re-forming on any new number.

The signals, page 100 and 101, *Changes from single column in line abreast* to *columns of divisions in line ahead and columns of divisions in line abreast*, are divisional and rectangular, and would prove most useful to the 'single ship' unit, and also to the 'group' unit.

The signals on pages 102 and 103, *forming column of sub-divisions in line ahead from single column in line abreast,* are rectangular but sub-divisional, and might prove useful in very large fleets.

The signals on page 104 and 105, *forming single column in line ahead or abreast from one or more columns in line abreast,* are divisional and rectangular, and would prove most useful.

The signals on page 106, *forming column of divisions in line abreast from column of sub-divisions,* might prove useful to very large fleets. The indented line would be most useful to the 'single ship' unit, and might be used with the 'group' formation.

The signals on page 109, *form line abreast, form one or more columns in line ahead,* are most useful for fleets when cruizing in the ordinary way, especially under sail in the time of peace; and on some occasions might be used with advantage for advancing on a pivot ship during evolutions.

The signals on page 110 and 111, *forming line abreast on each side of centre ship and two quarter lines,* would be most used when cruizing; but those on page 111 would be most valuable for both the 'single' and 'group' unit.

Page 112, *quarter lines on each side of leading ship* would be most useful when it was necessary to break from line ahead into echelon at the shortest possible notice.

Page 113, *columns in quarter line* on both sides of the leader, may be useful for a cruizing fleet, but I do not consider they could be used as forming any part of our Admiral's tactics in action. In the same way I do not consider that two bow lines can form any part of future tactical movements, though they might be used in a cruizing squadron.

Page 115, *inverting the column from van to rear,* by passing on the port (or starboard) side of next ahead will always be most useful signals; while columns in quarter line, with the leaders of the 2nd and 3rd divisions on a quarterly bearing would be most useful to the 'single' and 'group' unit. In case of an attack in three lines of groups, I know no better signals than these.

Page 117, *quarter lines,* would be useful for all purposes in many ways, but they are not absolutely necessary to the tactical manœuvring of a fighting fleet.

Signals, page 118, *two quarter lines from line abreast,* I should say, might be easily dispensed with, but those on page 119, *line ahead from quarter lines,* would still be useful.

Those on page 120 might be useful in a cruizing fleet, but of no use in tactical evolutions in the presence of an enemy. *To form columns in line abreast from one or more columns in bow or quarter lines* would be useful when moving from echelon to

line abreast, but the manœuvre could be perfectly well executed were this signal left out. The signals for the alteration of the course of the fleet, whether together or in succession, would be the same with the 'group' unit as they always have been with the 'single ship' unit, and would still do perfectly well for either. They would be constantly used in, or preparing for, an action, and should in consequence be frequently practised.

CHAPTER III.

ON THE SYSTEM OF COMMUNICATION FOR A GENERAL ACTION AT SEA.

WE have, at present, in the Navy two ways of communicating orders and directions from the Admiral to the Captains commanding the ships of the fleet. The first and most generally used is the Flag system, and were we able to ensure the absence of smoke from the funnel and guns, it would be almost perfect.

Secondly, we have the Semaphore, which of late years has come into such general use in the Navy. Almost every ship in commission has a small semaphore, and most useful they always prove to be. This is all very well in peace time, and the signalmen of flag ships stand gaily on the poop and 'sling the arms about' (as they call it), making and taking in as fast as possible. But let us for a moment imagine the difference there would be in a general action, and see if we cannot utilize this most necessary plan of communication for war purposes.

In the first place, I would suggest that every ship destined to be a sea-going fighting ship should be fitted

by the dockyard before she is commissioned, with a large semaphore worked by handles some way below the arms, and protected in a way that will render the man who is making the signal safe from the enemy's guns, or at the least from their rifles, the protection being fitted with small loop holes and a tube leading to wherever the Captain was likely to be in action—or some one stationed for the purpose of reporting the semaphore to the Captain. The advantage gained in action by having such a semaphore fitted in each ship would be very great; being low down and near the hull it could often be used below the smoke. It would be invaluable where two or three ships, just closing the enemy, wished to act in consort: question and answer at close quarter is almost instantaneous; and had the Admiral a few last orders after nearing the enemy and finding their position changed, a general semaphore would promulgate them.

The points to be attended to, in order to perfect this system as much as possible, are that the arms should be as large as possible, and broader in proportion to their length than those generally used at present; that the handles for working the arms should be easily moved and as small as possible; which can only be attained by the arms being exactly balanced. The semaphore must of course be in a place easily seen from the other ships; but, by having longer chains to the arms, there is no reason that the handles for work-

ing them should not be below; and the signalman stationed to work the handles would have nothing to think about but the signal he is making. When the arms of the semaphore are at rest they do not give a large mark for the enemy to aim at, and only stand the ordinary chance of damage from the shot and shell flying about that any other part of the machinery of war does in a general action. I am sure that every one who has been at all connected with signals during the last few years, will support what I say. I am certain that semaphores, fitted as above, would be invaluable in a 'general action at sea.'

As regards the training of signalmen and their making and taking in signals, both by flags and semaphore in the day-time and by the flashing system at night, I feel sure we should find them capable of making clear and correct reports, even under the (at present unusual) circumstances of a general action at sea; and I think our training ships may congratulate themselves on the knowledge shewn by the signal boys they yearly send to the ships in commission. As there is at present no special training for officers in signals or in the tactical manœuvres of a large fleet at sea, unless a young officer happens to be stationed in the signals when the ship to which he belongs is with a fleet, he grows up knowing little or nothing about it. I sincerely hope, when the value of the knowledge of tactical evolutions has become more

recognized, that a 'short course' will be opened for officers who wish to become acquainted with that important branch of their profession, somewhat similar to the 'Gunnery short course,' which all officers may now attend.

Before leaving this subject, I would suggest one more alteration in the evolutionary table, which I am certain would simplify it considerably; and that is that the word *column* should be omitted. *Divisions in line ahead; divisions in line abreast; quarter lines; single line ahead;* are all far more simple and easily understood when the word *column* has been dispensed with. I have found this especially in going through the different manœuvres with officers about to pass for Lieutenant, and with whom the object is to gain the greatest amount of information in the shortest possible time.

CHAPTER IV.

ON THE VARIOUS FIGHTING SHIPS IN THE NAVY, AND THEIR USE IN TACTICAL MANŒUVRES IN ACTION.

HAVING a stock of smokeless fuel at hand, a carefully reformed evolutionary table, and a perfect system of communication by day and night, we now come to the time when we may consider what vessels are to form the Fighting Fleet, and how far they are suited to develop the extreme power of the ram, heavy artillery, and the torpedo. In selecting the vessels from a list of our heavy iron-clads, turret ships, &c., we must still follow a rule by which to choose; still have a list of standard qualifications which should entitle a ship to take a place in that fleet, to whom, in the day of need, shall be entrusted the honour of old England.

1.—Great speed and coal carrying power.
2.—Thick plating (if possible, double bottom).
3.—Quickness in turning (highly important).
4.—Ability to keep the sea in all weathers.
5.—Capacity of stowing a large supply of provisions.

6.—Heavy armament (as regards penetration of guns).

Ships qualified as above might form the strength, or be the 'line-of-battle' ships of the squadron, while others of smaller size, and less powerful, should form the frigates or ships of the second line. A few, again, should be picked out for speed and ramming power, to act as fourth ships in the 'group' formation, if required; also to assist the despatch vessels in the look out for the enemy.

The first line, or line-of-battle ships, should be as nearly as possible of the same length and turning power, so that they might work easily together. Without reference to their armament, which is now quite a secondary (though important) consideration, the chief point being that they should arrive at their new stations in a 'change of formation' at the same moment; such ships as the *Minotaur*, *Agincourt*, and *Northumberland* should on no account belong to the fighting fleet, but should remain behind as a second line of defence. Their extreme length and the time they take to turn, their enormous complement of men, and the tremendous target they present for the ships of the enemy to fire at, ram, and explode torpedoes under, are anything but recommendations for their being placed in the fighting fleet of the future: nor is it desirable that they should; for it is obvious that in a war with a country whose Navy is equal, in strength,

to our own, we should have to place each ship composing our Navy, in that position where she will have the greatest opportunity of developing the resources, offensive or defensive, of the engines of war with which she may be supplied. From out of the remaining iron-clads of our Navy the following seem to me to be best to employ in a general action at sea as line-of-battle ships :—

Audacious	14 guns	6034 tons	4021 H.P.
Bellerophon	15 „	7551 „	7521 „
Devastation	4 turret	9188 „	5600 „
Hector	18 guns	6713 „	3256 „
Hercules	14 „	8677 „	8529 „
Invincible	14 „	6034 „	4832 „
Iron Duke	14 „	6034 „	4268 „
Lord Clyde	18 „	7842 „	6064 „
Lord Warden	18 „	7842 „	6706 „
Monarch	7 „	8322 „	7842 „
Fury	4 „	10886 „	7000 „
Thunderer	4 „	9188 „	5600 „
Repulse	12 „	6190 „	3347 „
Sultan	12 „	9286 „	8629 „
Swiftsure	14 „	6633 „	4913 „
Triumph	14 „	6633 „	4800 „
Valiant	18 „	6713 „	3560 „
Vanguard	14 „	6034 „	5312 „

I believe that the vessels mentioned in the above list would work well together, and are in every

way worthy of the first place in a general action in the open sea. What a mass of power would these eighteen ships be, formed in the order of attack! I should now, before going on to examine the new vessels of smaller tonnage, take a look at some of those noble vessels which were in the first rank a few years ago, and which I have no doubt will yet do good service.

Achilles	26 guns	9694 tons	5722 H.P.
Black Prince	28 „	9137 „	5722 „
Warrior	32 „	9137 „	5469 „
Royal Oak	24 „	6366 „	3704 „
Prince Consort	24 „	6832 „	4234 „
Defence	16 „	6070 „	2537 „
Resistance	16 „	6070 „	2428 „
Royal Alfred	18 „	6707 „	3434 „
Caledonia	24 „	6832 „	4538 „

These nine ships forming a squadron by themselves, with perhaps three smaller vessels working with them, to act as the fourth ship in their groups when required, or to make up the fourth group when not required as fourth ships, could work independently of the first line; and might often be detached from the main body of the fleet for the purpose of deceiving the enemy, or in furtherance of any strategical combinations which the Commander-in-Chief may wish to bring about. Their power of speed would enable them to keep up with the rest of the fleet when

cruizing; and they would never require to fight in consort with the main body, except to counterfeit some movement of the enemy, or to draw them in the direction required by the Admiral.

We now come to the third and smallest squadron of the fleet: but for all that, a powerful squadron still:—

Pallas	8 guns	3787 tons	3581 H.P.
Favourite	10 „	3232 „	1773 „
Penelope	11 „	4394 „	4703 „
Research	4 „	1741 „	1042 „
Enterprise	4 „	1350 „	692 „
Prince Albert	4 „	3905 „	2128 „
Hecate	4 „	3336 „	1625 „
Cyclops	4 „	3336 „	1660 „
Royal Sovereign	5 „	5080 „	2436 „
Hydra	4 „	3336 „	1625 „
Hotspur	3 „	4010 „	3497 „
Glatton	2 „	4840 „	2868 „

These last named are a very powerful fleet of themselves; and were it found that they could keep the sea in all weathers, they would be indeed a valuable assistance to the main body.

These, with the addition of a few despatch vessels of great speed, would, I imagine, form the fleet of the present day; the ships for defending our harbours being chosen from the last named squadron. Although it has pretty well been decided that it is not at all

necessary that all the ships in a large fleet should work and move with the same speed, and in the same squadron, still, I should say that eighteen is the lowest number that the main body ever should be allowed to be reduced to. Even now, to the ships I have mentioned as line-of-battle ships, I would add six smaller vessels, to act as the fourth ship in 'group' formation; and these six need not necessarily carry guns. Great power of turning and ramming would be their best qualifications for the service required of them. Of this I shall speak later when entering into the question of 'formations for attack,' etc.

CHAPTER V.

TACTICAL MANŒUVRES FOR A GENERAL ACTION IN THE OPEN SEA.

"QUE LA GUERRE N'EST AUTRE CHOSE QUE L'ART DE REUNIR PLUS DE MONDE QUE L'ENNEMI SUR UN POINT DONNÉ.—*Napoleon.*

I CHOSE the above as the motto for this essay on account of the truth which I believe every word of it contains. That the assembling of a larger force than the enemy, on any given point, is the one object to be attained, the one end and aim of all strategical combinations, I feel perfectly convinced. Nelson, our great Naval leader, won his victories on this principle; and Napoleon enunciates it as the first tenet of his creed. Those who wish to follow in their footsteps must accept this as a first principle. Even had these great men kept silent on the subject, it would still be obvious to all who deeply study the question that in the fleets of the future no matter how the vessels are altered, concentration of strength on a given point must still, as ever, be the first principle of war. There is always a tendency, in writing anything that one wishes to be new, to do away with all that is or has

been, but in tactical manœuvres, as in everything else, we would do well to remember that we cannot obtain one glimpse of the future but through the medium of a reflected past.

The point which I, therefore, particularly wish to bring forward is how to concentrate a fleet by a system of tactical manœuvres and formations, such formations to be able to move readily to a new front or direction, or to a new point of concentration. Had I a fleet consisting of twelve ships in action, against a fleet of twelve ships of the enemy, I would do my best to manœuvre so as to fight them one at a time, at 'twelve to one,' and failing this, two together, and so on; last of all, would I fight the whole twelve at the same time—that would indeed be a *dernier ressort.*

It is the necessity of possessing this power of concentration that renders it so desirable that the unit of our evolutionary system should be changed. Having decided that question, the next thing to be considered is to what number we should change it. It seems to me to rest between two, three, and four; and I feel sure that the simplest way we can settle the question will be to employ all three, which can be done by the very simple contrivance of changing the unit from a 'single ship' to a 'group,' which 'group' shall consist of two, three, or four, at the discretion of the Commander-in-Chief, according to the numerical strength and individual size of his squadron.

The word 'group' should be given a meaning clearly laid down in the general signal book. In the event of there being only two ships in each group, the second ship should form four points on the port or starboard quarter of the first, so as to have the broadside, bow, and stern fire of both ships clear. As sub-divisions must always, at present, either be in line ahead or line abreast, the 'group' must obviously be a better formation than the sub-divisional, especially where they both consist of two ships. In sub-divisions, line ahead, the bow fire of one ship and the stern fire of the other is rendered useless by one ship being in the way of the other. The same in line abreast—one broadside of each ship is rendered useless.

In the case of the group of two, one on the quarter of the other, neither ship is in the way of the other's fire, and these two, becoming the unit and working together as one ship, will greatly simplify the manœuvres in a large fleet. With two ships in the 'group,' the second ship should have a constant distance of two cables from the leader. In case of altering course sixteen points, the second ship may become leader by the signal to *reform on No. 2*, or No. 1 may pass ahead and lead again.

Again, when the numerical strength of the fleet would allow of it, the Commander-in-Chief might tell them off to groups of three.

In this case the second ship should be four points

on the starboard or port quarter of the first, and two cables from her; and the third ship four points on the port or starboard of the second ship, and three cables distant from her. This would bring the third ship seven points abaft the port or starboard beam of the leader of the group. When practising this formation in the Channel the third ship took her bearing and distance from the second ship in the group. The reason for this is that in an alteration of course it is easier to re-form on the second ship. As may be seen by the Figure, they will all be clear of each other's bow, stern, and broadside fire. My own opinion, and the result of what experience I have had confirms me in it, is that this group of three is the happy medium that will best suit our tactical manœuvres for the future.

It may be sometimes advantageous to attach a fourth ship to the group, and when that is the case, she should form four points on the starboard or port quarter of the third ship, and two cables from her; by this plan she would also have her bow, stern, and broadside fire clear of the other ships composing her group; and their fire would be perfectly clear of her. By having a fourth ship in the group the fleet becomes more concentrated; but in forming in echelon (or groups in quarter line) the second group would have to be farther astern of the first, and so on down the line, so as to keep the fire of all groups clear

in every direction. But, again, if you had three ships in each group, those that would have been used as fourth ships would have to form in separate groups, and the line would be extended just the same.

I mention, therefore, that the question of the fourth ship is one to be decided by the Commander of each squadron in any way that he thinks may best suit the force placed under his command. Having once organised the fleet in groups, they should always form according to that organization whenever the group flag is hoisted; remaining and working as such until it is annulled. The officer commanding the leading ship of a group should have entire control over that group, and the remaining vessels should preserve their stations on him without reference to any other part of the fleet. When the fleet is in any formation in line of groups, the second in one group should bear from the second in any other, as her leader does from the leader of that other. Leaders would preserve their bearings and distances from the leader of the leading group.

What I should suggest for adoption in our service is, that a fleet on first starting should always be organised in groups containing the number of ships that suits it best, and form accordingly whenever the unit is changed. There is no formation that will develop to so great an extent the heavy artillery of our vessels, whether they are sent into action with their

present armament or whether the broadside gives way entirely to the central battery in the future. Having given the broadside, bow, and stern fire by this formation to the heavy artillery, we will now investigate how far it is useful in developing the powers of the ram, and also how far it prevents the ships of the enemy using their rams, should they be in any other formation.

When we have three ships in the group, one on each quarter of the leader, at the different distances of two cables and three cables and a quarter, if No. 1 attempts to ram the vessel opposed to her, she must sheer out of her course right across the bows of No. 2 and 3; and on the other hand, a ship of the enemy attempting to ram the leader of a group, unless backed up by a group on his side, must be rammed either by No. 2 or 3; in case of his escaping them, would probably have to run the gauntlet across the bows of the whole quarter-line. The fourth ship would be very useful for this sort of work, as the commander of the group might detach her at any moment, and still preserve his group of three intact. Great turning power and capability of increasing speed quickly to a very high rate will always be the most important qualities for the third or fourth ship of a group. Turning power I look upon as the most important quality for any ship when used as a ram; the perfection of manœuvring will be obtained when ships

can turn at right angles to their course instantaneously, therefore, every step we make towards that highly desirable end is in the right direction. Artillery and small arms may annoy the enemy and be most useful in keeping him from seeing too much of what is going on, but the ram will be the weapon with which an opportunity will be seized, and a decisive blow struck. I believe that the 'group' formation is the handiest for ramming, and the safest from being rammed, of any yet brought forward.

The development of the powers of the torpedo in a general action, must, in my opinion, depend more upon the fitting of the ships for that particular kind of warfare, than on the formation they happen to be in at the moment of attack. That, it, (the torpedo) must be, for the future, of the greatest service in a general action at sea, there can be little doubt. The two points we have to deal with in discussing any part of the matériel of war, are—how to use it to our greatest advantage in attack, and how to defend and protect ourselves from it when used by the enemy.

In the first place we will take it as a means of attack in a general action at sea.

The torpedoes we have to attack with are 'Harvey's towing' and 'Whitehead's fish.' I am of opinion that the line-of-battle ships should rather be fitted with a means of defence against torpedoes, than fitted to use them in attacking. They might

carry a torpedo ('Harvey') on each quarter, ready to launch overboard should a good opportunity offer of dragging it under the bottom of one of the enemy's ships; but such torpedo should be exploded by electricity, and not by contact with another body; and should not be used at all unless certain of success. I look upon the work of the line-of-battle ship in a general action at sea to be the effective discharge of her heavy artillery—the destruction of all that she can get to stand in her way, by using her ram; and the preserving of the general formation of the fleet as far as lies in her power. But, though she may not attack with torpedoes herself, there is no reason her boats should not. Every fighting ship should be fitted with two very fast steam torpedo quarter boats, each fitted for the use of the bow pole torpedo, 'Harvey's' towing torpedo, and 'Whitehead's' fish torpedo. Their speed should reach, if possible, twelve knots. They should be fitted with lowering apparatus capable of lowering them at a speed of ten knots in ordinary weather, and they might be lowered by all ships of the fleet just as they came up with the enemy. Thus, with a fleet of eighteen ships you would have thirty-six small torpedo steamers down in an instant, dealing destruction on all wounded vessels of the enemy—getting under their bows, and discharging fish torpedoes at those going at a high speed, and dragging the towed torpedo under the bottoms of any ship whose way

was stopped by collision or otherwise. That these boats would run but little risk may easily be imagined, as the enemy themselves would be far too busily employed in preventing themselves from being rammed, in ramming, and firing heavy artillery, to be able to pay much attention to these small destructive torpedo-boats, who would be darting about in all directions.

Besides these quarter boats, or in the case of their not being fitted as above, I think that every fighting line-of-battle ship should have a torpedo tender—a vessel of two to four hundred tons—in which nothing but speed, turning power, and torpedo fittings have been considered; the bow tube, the towing, and fish torpedoes would all be in readiness for use at a moment's notice. She should keep close to her line-of-battle ship, carefully keeping out of the line of fire and out of the way, watching her opportunity to dart out and use her offensive weapons, or get right in the way so as to cause the enemy's vessel to give a sheer, or run her down and entangle herself ready for the next line-of-battle ship to ram or the next tender to blow up. These tenders would be most useful in towing disabled vessels out of action, in assisting the look-out vessels when searching for the enemy, and also in rescuing and taking on board any of the small quarter torpedo boats' crews which may have been swamped by the enemy's fire.

It may be urged in argument against this suggestion, that these tenders would be constantly in the way of manœuvres; but I do not see that it is at all necessary that they should be so. I firmly believe that they would give most useful and valuable assistance in a general action. They should be armed with mitrailleuses, in case of their having to cope with anything the enemy might bring to assist in the working of their torpedoes.

As regards the defensive powers of the line-of-battle ship, it should be the duty of the small steamers to keep boats from coming too close; the ships themselves keeping at the highest possible speed. A very sharp instrument should be run up the stem and after part of the rudder to cut away any torpedo towing line that might cross the bow or come up under the stern. Of the latter there would not be so much danger as long as the speed is kept up; and the very fact of the ship going fast through the water, with this sharp saw instrument at the bow, would cut through the torpedo towing line in an instant. Every ship should have mitrailleuses and small guns for the destruction of torpedo boats close alongside. The greatest care should be taken and every means used to prevent the screw fouling. The small quarter-boats that are lowered should be supplied with ropes, nets, etc., to try and foul the screws of the enemy; they should also be supplied with a torpedo to be towed between them, so

that, on an enemy's ship coming towards them, they might place themselves one on each bow, with the torpedo directly in her track, and as she came over it, steam away in opposite directions and explode it under her bottom. In case she sheered out of the way, her broadside would be exposed, and the line-of-battle ship, always ready for a chance, would ram her. It is difficult to say how useful these boats would prove. My impression is that they would be invaluable, and most destructive to the enemy. The hotter the action became and the greater the confusion, the more it would be necessary to use the small boats, and in charge of cool and practised officers there is no saying the mischief they might not do to the enemy. One group should consist (if the fleet were sufficiently large) of three line-of-battle ships, three tenders, and six torpedo quarter boats. The tenders might, except when on the look out, always be towed about by their own line-of-battle ship, keeping their coal for the actual time of action. I firmly believe that the above formation would give the greatest effect to our heavy artillery, a very great, if not the greatest, chance to our ships of using their rams, and would also develop the power of the torpedo to its fullest extent.

Having selected the unit of formation that will best suit our means of attack, we will now consider the strategical question of approaching the enemy and the best line of formation for attack and defence.

Every fleet, however small, on or before putting to sea, should be fully and completely organized. Fleet numbers should be given, and all divisions and sub-divisions of the squadron made and clearly understood. Fleet numbers are, as a rule, given to the ships according to the seniority of their Captains; that is to say, although they do not come in rotation according to seniority, still their seniority is the only thing taken into consideration when the fleet is being organized. This rule is undoubtedly a good one, but no Commander-in-Chief should be tied down to follow it implicitly; there may be many occasions when the form, armament, or turning power of one of the ships of the present day would unfit her for her station by seniority, and render her admirably fit for some other. This should be the exception to the rule.

The groups should be told off, and whether they were to consist of three or four ships made generally known. Tenders, where ships had them, should possess the same number pendants, etc., as the line-of-battle ship to which they are attached, and should in every way be part and parcel of her. Should there be only one tender to each group, then he should have the number pendants, etc., and be part and parcel of the leader of that group; only there should be a tender pendant or flag always flown when addressing the tenders. The organization being complete, no opportunity should be lost in exercising the

fleet in the different formations, changes of unit, etc.; and a system of lookouts and communication by repetition, etc., organized and put into place. First sight of the enemy must always be advantageous to the attacking force, inasmuch as it gains a little more time for the preparation and instructions.

In the day time a fleet never could be taken by surprise, and, if having anything like the speed of of the enemy, may bring the action on at any time that may be most convenient. Look-out ships should at once report the strength of the enemy and the formation they are in, course they are steering, &c.; and as the enemy approaches, they should close towards their own flag-ship, continually keeping the Commander-in-Chief imformed of all changes in the position and formation of the enemy, until he can clearly make them out from his own flag ship. It is impossible to lay down any rules for closing with the enemy, so much depends on his force and formation; but one thing is certain, that our force should be as much concentrated as possible, and the smaller the front, in the direction of the enemy, the easier will it be to manœuvre the fleet when close to them. I hold that the fleet should be formed into groups, of three or four in each, and worked on this way during the action, giving the leader of a group full power to work that group in any way he likes, once the general mêlee has begun. I would have two lines of attack, the port

line of attack and the starboard line of attack. In the port line of attack the second ship should be on the port quarter of the leader of a group, and the leader of the group on the port quarter of the Admiral. In the starboard line of attack the second ship should be on the starboard side of the 'group' leader, and the group on the starboard quarter of the Admiral. Changes from one to the other may easily take place at any time; forward movements are easily made in this formation; lines to the right or left are formed with the greatest facility, that is, always provided a group is treated as a 'single ship.'

In this formation it must be allowed that the fleet is concentrated in itself, and is capable of being thrown in that state on any weak point of the enemy. As regards the speed at which the ships ought to be moving, I consider that one of the most important points is that all the ships of the fleet should be capable of largely increasing the speed at which the fleet is steaming on coming into action. I cannot see any advantage in closing the enemy at a very high speed; but once close to them and in the formation in which you must come into action, then increase to the highest speed of the slowest ship. To concentrate a greater number of ships on a given point than the enemy, must also be taken into consideration when the fleets are being brought together in the time of war; and England, to be certain of naval victories,

must always be able to mass a greater number of ships on any given point than any other nation in the world. I will not attempt to go into the various changes of formation, simply stating that the present system and signal book adapted to the 'change unit-flag' would, I believe, give every change of formation that would be required.

I would urge, in conclusion, what an important place tactical manœuvres should take in our Naval education. From the earliest period of his career, no officer can study too carefully the signal books and the system of large fleets and squadrons acting in unison.

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